Reno-Stead Airport
Master Plan Update
Final Report

Prepared By

PBS&J®

March 2010

RENO-STEAD AIRPORT
MASTER PLAN UPDATE

FINAL REPORT

PREPARED FOR:

RENO-TAHOE AIRPORT AUTHORITY

PREPARED BY:

PBS&J®

MARCH 2010

TABLE OF CONTENTS

LIST OF FIGURES ..... **vii**

LIST OF TABLES ..... **ix**

CHAPTER ONE **1-1**
INTRODUCTION
1.1 General Overview 1-1
1.2 Master Plan Goals 1-1
1.3 Summary and Recommendations 1-3

CHAPTER TWO **2-1**
INVENTORY OF EXISTING FACILITIES
2.1 General Overview 2-1
2.2 Airport Description 2-1
2.3 History 2-1
2.4 Airside Facilities 2-4
2.4.1 Runways 2-4
2.4.2 Taxiways 2-6
2.4.3 Aircraft Parking Apron 2-6
2.5 Meteorological Conditions 2-7
2.5.1 Climate 2-7
2.5.2 Wind 2-7
2.6 Facility Design Criteria 2-7
2.7 Navigational Aids 2-10
2.7.1 Enroute Navigational Aids 2-10
2.7.2 Terminal Area Navigation and Landing Aids 2-11
2.7.3 Airport Lighting Aids 2-11
2.8 Existing Landside Facilities 2-12
2.8.1 Terminal Facility 2-12
2.8.2 Aircraft Hangars 2-12
2.8.3 Fixed Based Operator (FBO) 2-12
2.8.4 National Championship Air Races and Air Show 2-13
2.8.5 Other Aviation Tenants 2-13
2.8.6 Aircraft Rescue and Fire Fighting 2-15
2.8.7 Fuel Facilities 2-15
2.8.8 Automobile Parking and Ground Access 2-15
2.9 Existing Environmental Considerations 2-16
2.9.1 Aircraft Noise 2-16
2.9.2 Drainage Patterns 2-16
2.9.3 Water Supply 2-16
2.9.4 Existing Hazardous Waste Monitoring Sites 2-17
2.10 Utilities 2-17
2.11 Land Use 2-20
2.12 Airspace Structure 2-23
2.12.1 Instrument Approach Procedures 2-30
2.12.2 Part 77 Obstructions to Navigable Airspace 2-30
2.12.3 Special-Use Airspace 2-30
2.13 Airports in the Vicinity 2-30
2.13.1 Private-Use 2-34
2.13.2 Public-Use 2-36
2.13.2.1 Reno-Tahoe International Airport 2-36
2.13.2.2 Truckee-Tahoe Airport 2-36

2.13.2.3 Nervino Airport....2-36
2.13.2.4 Sierraville-Dearwater Airport....2-36
2.13.2.5 Spanish Springs Airport....2-36
2.13.2.6 Carson City Airport....2-36
2.13.2.7 Parker Carson STOLport....2-37
2.13.2.8 Dayton Valley Airport....2-37
2.13.2.9 Tiger Field....2-37
2.13.2.10 Minden-Tahoe Airport....2-37
2.13.2.11 Lake-Tahoe Airport....2-37
2.14 Area-Wide Plans....2-37
2.14.1 2030 Regional Transportation Plan....2-38
2.14.2 Nevada Airport System Plan....2-38
2.14.3 North Valley Area Plan....2-38
2.14.4 Truckee Meadows Regional Plan....2-38
2.14.5 Washoe County Comprehensive Plan....2-39
2.14.6 City of Reno Master Plan....2-39
2.14.7 Washoe County Consensus Forecasts....2-39
2.14.8 National Plan of Integrated Airports System (NPIAS)....2-40
2.15 Airport Surveys and Tenant Interviews....2-40

CHAPTER THREE....3-1
FORECAST OF AVIATION DEMAND
3.1 General Overview....3-1
3.2 Defined Air Trade Area....3-1
3.3 Demographic and Economic Data....3-1
3.3.1 Population....3-3
3.3.2 Employment....3-3
3.3.3 Total Earnings....3-8
3.3.4 Per Capita Income....3-8
3.4 Methodology....3-13
3.5 Forecasting Trends and Considerations....3-13
3.5.1 National General Aviation Trends....3-13
3.5.1.1 Active Shipments and Billings....3-14
3.5.1.2 Active GA Fleet....3-14
3.5.1.3 Hours Flown....3-14
3.5.1.4 Active Pilots....3-15
3.5.2 Regional and Local Trends....3-15
3.5.2.1 Quality of Life....3-15
3.5.2.2 Location and Market Access....3-15
3.5.2.3 Favorable Tax Environment....3-16
3.5.2.4 Business Friendly Climate....3-16
3.5.2.5 Tourism....3-16
3.6 Based Aircraft Forecast....3-17
3.6.1 Trend Line Analysis....3-17
3.6.2 Regression Analyses....3-18
3.6.3 Market Share Analysis....3-20
3.6.4 Selected Based Aircraft Forecast....3-22
3.7 Forecast of Based Aircraft – Fleet Mix....3-24
3.8 Forecast of Aircraft Operations....3-24
3.8.1 Total Operations....3-24
3.8.2 Forecast of Itinerant and Local Operations....3-27

3.8.3 Forecast of Military Operations....3-28
3.9 Alternative Forecasts....3-28
3.10 Forecast of Instrument Operations....3-30
3.11 Forecast of Peak Operations – Month, Day and Year....3-31
3.12 Forecast of Fuel Flowage....3-32
3.13 Forecast Summary....3-32

CHAPTER FOUR....4-1
DEMAND/CAPACITY ANALYSIS AND FACILITY REQUIREMENTS
4.1 General....4-1
4.2 Airspace Capacity....4-1
4.3 Airside Capacity and Facility Requirements....4-1
4.3.1 Airfield Capacity....4-3
4.3.1.1 Airfield Parameters and Assumptions....4-4
4.3.1.2 Airfield Capacity Calculations....4-6
4.3.2 Runway and Taxiway System Design Requirements....4-8
4.3.2.1 Runway 8-26....4-9
4.3.2.2 Runway 14-32....4-10
4.3.2.3 Runway Designations....4-11
4.3.2.4 Runway Length Requirements....4-11
4.3.2.5 Taxiway Requirements....4-12
4.4 Approach and Navigational Aids....4-13
4.5 Airfield Lighting, Signage, and Pavement Markings....4-13
4.5.1 Airfield Lighting....4-13
4.5.2 Airfield Signage....4-14
4.5.3 Pavement Markings....4-14
4.6 Aircraft Aprons and Tie-Downs....4-14
4.7 Aircraft Hangars....4-16
4.8 Fuel Flowage....4-17
4.9 Terminal Building & FBO....4-19
4.10 Terminal Area Automobile Parking....4-20
4.11 Ground Access....4-20
4.12 Airport Security....4-22
4.13 Airport Rescue and Firefighting....4-23
4.14 Air Traffic Control Tower....4-23
4.14.1 Critical Values and Other FAA Assumptions....4-24
4.14.2 Benefit/Cost Analyses....4-25
4.15 Non-Aviation Use....4-25
4.16 Summary....4-25

CHAPTER FIVE....5-1
AIRPORT DEVELOPMENT PLAN
5.1 General....5-1
5.2 Approach....5-1
5.3 Airfield Elements....5-2
5.3.1 Runway Improvements....5-2
5.3.1.1 Extend and Displace Runway 8-26 for RSA Compliance....5-2
5.3.1.2 Implement Declared Distance on Runway 14-32 for RSA Compliance....5-3
5.3.2 Taxiways....5-3
5.3.2.1 Parallel Taxiways....5-3
5.3.2.2 Rehabilitation of Taxiway D....5-3
5.3.2.3 Rehabilitation of Closed Taxiway....5-3

5.3.2.4 Connector Taxiways 5-3
5.3.3 Navigational Aids 5-4
5.4 Landside Elements 5-5
5.4.1 Aircraft Storage Hangars 5-5
5.4.2 Aircraft Aprons 5-5
5.4.3 General Aviation Terminal Building 5-5
5.4.4 Air Traffic Control Tower 5-5
5.4.5 Aviation Needs Summary 5-6
5.5 Development Plan 5-6
5.5.1 Aviation Use Areas 5-6
5.5.2 Non-Aviation Areas 5-9
5.5.3 Unconstrained Land Use Concept 5-9
5.5.4 Constrained Land Use Concept 5-9
5.6 Summary 5-12

CHAPTER SIX 6-1
DRAINAGE MASTER PLAN
6.1 Introduction & Purpose 6-1
6.2 Procedures & Criteria 6-1
6.2.1 Previous Studies 6-1
6.2.2 Compliance with the Draft Truckee Meadows Regional Drainage Manual 6-5
6.2.3 Hydrologic Procedures 6-5
6.2.3.1 Precipitation 6-6
6.2.3.2 Curve Number 6-6
6.2.3.3 Lag Time 6-10
6.2.4 Hydraulic Procedures 6-10
6.3 Hydrologic Analysis 6-10
6.3.1 100-Year, 24-Hour Analysis 6-12
6.3.2 100-Year, 10-Day Analysis 6-14
6.4 Hydraulic Analysis 6-15
6.5 Erosion Control 6-15
6.6 Conclusions 6-17

CHAPTER SEVEN 7-1
AIRPORT LAYOUT PLAN
7.1 General 7-1
7.2 Cover Sheet 7-1
7.3 Drawing of Existing Facilities 7-1
7.4 Airport Layout Plan Drawing 7-5
7.5 Terminal Area Plan 7-5
7.6 Runway Approach and RPZ Plan 7-5
7.7 Airport Airspace Plan 7-12
7.8 Land Use 7-12
7.9 Airport Property Map 7-13

CHAPTER EIGHT 8-1
CAPITAL IMPROVEMENT PROGRAM
8.1 Introduction 8-1
8.2 Development Phasing 8-1
8.3 Development Considerations 8-2
8.4 Capital Improvement Program 8-3
8.5 Implementation 8-12
8.5.1 Historical Airport Financial Data 8-12

8.5.1.1 Revenue Sources 8-12
8.5.1.2 Expenses 8-12
8.5.2 Projected Revenue and Expenses 8-13
8.5.3 Capital Program Funding Sources 8-14
8.5.3.1 Federal Funding 8-14
8.5.3.2 Local Funding 8-14
8.5.3.3 Other Funding 8-15
8.5.4 Summary 8-15

APPENDICES

APPENDIX A - KICKOFF MEETING DOCUMENTATION

APPENDIX B - AIRPORT SURVEYS

APPENDIX C - ATCT PRELIMINARY BENEFIT/COST ANALYSIS

APPENDIX D - ATCT SITING STUDY

APPENDIX E - DRAINAGE

APPENDIX F – COST ESTIMATES

LIST OF FIGURES

CHAPTER TWO **2-1**
INVENTORY OF EXISTING FACILITIES
2-1 Location Map 2-2
2-2 Vicinity Map 2-3
2-3 Existing Airside Facilities 2-5
2-4 Existing Apron and Terminal Area 2-8
2-5 All Weather Wind Rose 2-9
2-6 National Championship Air Race Courses 2-14
2-7 Water Service Providers 2-18
2-8 Waste Areas and Monitoring Wells 2-19
2-9 Selected Tracy/Silver Lake Transmission Lines Agreement 2-21
2-10 Existing Utility Network 2-22
2-11 Existing Land Use 2-24
2-12 Existing Zoning 2-25
2-13 Airspace Classes 2-26
2-14 VFR Airspace Structure 2-27
2-15 Low Altitude Airspace Structure 2-28
2-16 High Altitude Airspace Structure 2-29
2-17 GPS Runway 32 2-31
2-18 VOR/DME or GPS RWY 32 2-32
2-19 ILS Approach RWY 32 2-33
2-20 Typical Precision Approach Part 77 Surfaces 2-34
2-21 Airports in the Vicinity 2-35

CHAPTER THREE **3-1**
SOCIO-ECONOMIC CHARACTERISTICS
3-1 Catchment Area 3-2
3-2 Historical and Projected Population 3-5
3-3 Historical and Projected Employment 3-7
3-4 Historical and Projected Earnings 3-10
3-5 Per Capita Income 3-12
3-6 Extrapolated Weather Distribution for Reno-Stead 3-30

CHAPTER FOUR **4-1**
DEMAND/CAPACITY ANALYSIS AND FACILITY REQUIREMENTS
4-1 Precision Approach Overlaps Between RTS and RNO 4-2

CHAPTER FIVE **5-1**
AIRPORT DEVELOPMENT PLAN
5-1 Airport Development Plan 5-7
5-2 General Development Plan 5-8
5-3 Conceptual On-Airport Development Plan Unconstrained 5-10
5-4 Conceptual On-Airport Development Plan Constrained 5-11

CHAPTER SIX **6-1**
DRAINAGE MASTER PLAN
6-1 Area/Vicinity Map 6-2
6-2 Overall Watershed Map 6-3
6-3 Proposed Condition Land Use Map 6-4
6-4 Existing Condition Watershed Map 6-7
6-5 Proposed Condition Watershed Map 6-8
6-6 Soils Map 6-9

6-7 Proposed Drainage Improvements Map....6-16

CHAPTER SEVEN **7-1**
AIRPORT LAYOUT PLANS
7-1 Cover Sheet 7-2
7-2 Existing Facilities A 7-3
7-3 Existing Facilities B 7-4
7-4 Airport Data Sheet....7-6
7-5 Airport Layout Plan A 7-7
7-6 Airport Layout Plan B 7-8
7-7 Terminal Area Plan....7-9
7-8 Runway 8-26 Approach and RPZ Plans....7-10
7-9 Runway 14-32 Approach and RPZ Plans....7-11
7-10 Runway 8-26 Part 77 Surfaces Plan 7-14
7-11 Runway 14-32 Part 77 Surfaces Plan 7-15
7-12 Runway 8-26 and 14-32 Part 77 Surfaces Plan Match Lines....7-16
7-13 Land Use....7-17
7-14 Airport Property Map 7-18

CHAPTER EIGHT....**8-1**
CAPITAL IMPROVEMENT PROGRAM
8-1 Phase I Development Plan....8-6
8-2 Phase II Development Plan....8-8
8-3 Phase III Development Plan....8-10
8-4 Phases I, II, III Development Plan....8-11

LIST OF TABLES

CHAPTER TWO **2-1**
INVENTORY OF EXISTING FACILITIES
2-1 Runway Specifications 2-6
2-2 Aircraft Approach Speed Categories 2-10
2-3 Airplane Design Group by Wingspan 2-10
2-4 RSARC Zoning District 2-23
2-5 Private Use GA Airports in the Region 2-34
2-6 Consolidated Results of Airport Surveys and Tenant Interviews 2-41

CHAPTER THREE **3-1**
SOCIO-ECONOMIC CHARACTERISTICS
3-1 Historical and Projected Population 3-4
3-2 Historical and Projected Employment 3-6
3-3 Historical and Projected Earnings (in Thousands) 3-9
3-4 Historical and Projected Per Capita Income 3-11
3-5 Historical Based Aircraft 3-18
3-6 Trend Analysis Results 3-19
3-7 Regression Analysis Results – Single Independent Variable 3-20
3-8 Market Share Results 3-21
3-9 Selected Forecast of Based Aircraft 3-23
3-10 Forecast of Based Aircraft – Fleet Mix 3-25
3-11 Forecast of Total Operations 3-26
3-12 Forecast of Itinerant and Local Operations 3-27
3-13 Forecast of Military Operations 3-28
3-14 Alternative Forecast of Total Annual Aircraft Operations 3-29
3-15 Forecast of Total ILS Operations 3-31
3-16 Forecast of Peak Operations 3-32
3-17 Forecast of Fuel Flowage (in Gallons) 3-33
3-18 Summary of Forecast Activity 3-34

CHAPTER FOUR **4-1**
DEMAND/CAPACITY ANALYSIS AND FACILITY REQUIREMENTS
4-1 Private- and Public-Use Airports in the Region 4-3
4-2 Estimated Runway Utilization 4-4
4-3 FAA Aircraft Classifications 4-5
4-4 Aircraft Mix Index Projection 4-5
4-5 Annual Service Volume vs. Annual Demand 4-8
4-6 Airport Reference Code Breakdown 4-9
4-7 Declared Distances for Runway 8-26 4-10
4-8 Declared Distances for Runway 14-32 4-11
4-9 Runway Designation Calculation 4-11
4-10 Runway Length Requirements 4-12
4-11 Based Aircraft Apron Requirements 4-15
4-12 Itinerant Aircraft Apron Requirements 4-16
4-13 Aircraft Hangar Requirements 4-17
4-14 Annual Fuel Demand 4-18
4-15 AVGAS Fuel Storage Requirements 4-18
4-16 Jet A Fuel Storage Requirements 4-19
4-17 Terminal Building Requirements 4-21
4-18 Automobile Parking Requirements 4-22
4-19 FAA Critical Values & Assumptions 4-24

4-20 Summary of Facilities Requirements....4-26

CHAPTER FIVE....5-1
AIRPORT DEVELOPMENT PLAN
5-1 RTS NAVAIDS....5-4

CHAPTER SIX....6-1
DRAINAGE MASTER PLAN
6-1 Previous Drainage Reports....6-1
6-2 100-Year, 24-Hour Land Use Summary....6-6
6-3 Summary of HEC-1 Models....6-11
6-4 Alternatives Matrix....6-12
6-5 100-Year, 24-Hour HEC-1 Summary....6-14
6-6 100-Year, 10-Day HEC-1 Summary....6-14

CHAPTER EIGHT....8-1
CAPITAL IMPROVEMENT PROGRAM
8-1 Airport Capital Improvement Program....8-2
8-2 Summary of Cost Estimates – Full Build-Out....8-3
8-3 Capital Improvement Program Phase I (2009-2013)....8-4
8-4 Capital Improvement Program Phase II (2014-2018)....8-7
8-5 Capital Improvement Program Phase III (2019-2028)....8-9
8-6 Historical Revenues....8-12
8-7 Historical Expenses....8-13
8-8 Historical Financial Analysis....8-13
8-9 Projected Revenue and Expenses....8-14

INTRODUCTION
Reno-Stead Airport

1

1.1 GENERAL OVERVIEW

The Reno-Stead Airport Master Plan Update (Master Plan) was a cooperative effort between the Reno-Tahoe Airport Authority (RTAA) and the Federal Aviation Administration (FAA). This Master Plan provides an effective written and graphical representation of the ultimate development of the Reno-Stead Airport (RTS) and the anticipated land uses and development opportunities on RTS. It is the intent of the Master Plan to serve as a management guide for the phased implementation of necessary improvements to meet the expected growth in aviation demand at RTS over a planning period of 20 years, ending in 2028.

RTAA, the owner and operator of both the Reno-Tahoe International Airport (RNO) and RTS, recognizes the importance of RTS to the community and the region. This Master Plan establishes a schedule of priorities and phasing for the various improvements proposed and provides information and guidance to manage and develop facilities to meet the forecasted growth and stimulate business investment in the local economy. An Airport Layout Plan (ALP), which is essential to an airport's ability to qualify for and receive federal and/or state funding assistance, has been included in this Master Plan. In addition to providing the traditional planning guidance described, this Master Plan update examines issues unique to RTS, specifically the large amount of undeveloped land that is part of RTS property and required regional drainage needs. The outcome is a document that not only ensures that RTS will meet projected aviation demands, but also one that will serve as a strategic development plan and marketing tool for RTS, as well as for the RTAA in guiding their airport system as a whole.

1.2 MASTER PLAN GOALS

Six Master Plan goals and additional work tasks were identified after the project kick-off meeting. **Appendix A** provides the agenda, list of meeting attendees and elaboration on the six goals which are as follows:

- Goal No. 1: Provide an airport that is safe, secure and reliable, while continuing to maintain the existing high level of service provided to all RTS users and tenants
- Goal No. 2: Provide planning and development guidance to satisfy anticipated aviation demand and to promote fiscal self-sufficiency by stimulating RTS development and the local economy
- Goal No. 3: Minimize or avoid any negative environmental impacts from proposed development
- Goal No. 4: Promote the development of appropriate and achievable compatible non-aviation land use in undeveloped areas within the RTS
- Goal No. 5: Address infrastructure needs and local drainage issues at RTS
- Goal No. 6: Identify an appropriate development phasing program in association with the airport land use and development plan

To accomplish the goals of the Master Plan, the work tasks included:

- Collecting data and evaluating existing airport facilities and activity (Chapter 2 Inventory of Existing Facilities)
- Reviewing previous forecasts and preparing updated forecasts that provide short, intermediate, and long range (5, 10 and 20 years) projections of aviation demand (Chapter 3 Forecast of Aviation Demand)
- Identifying impacts of the forecast activity on existing facility capacities and determining the enhancements necessary to meet projected demand (Chapter 4 Demand/Capacity Analysis and Facility Requirements)
- Identifying aviation and non-aviation development opportunities, determining which types are appropriate and desired by the RTAA, preparing and evaluating various development alternatives (with and without the National Championship Air Races and Air Show) and selecting a final development concept (Chapter 5 Airport Development Plan)
- Developing alternatives to address airport and local drainage issues, including major drainage collection channels and a possible regional retention basin, in coordination with other involved jurisdictions/agencies (Chapter 6 Drainage Master Plan)
- Refining the selected airport development concept as necessary and developing a graphic representation of existing and proposed development including a complete ALP package (Chapter 7 Airport Layout Plan)
- Determining the airport capital improvements program (costs and revenue), development phasing plan and implementation plan for the proposed development program (Chapter 8 Capital Improvement Program)
- Conducting a public information outreach program to obtain input for the master planning process

The RTS Master Plan was funded by the FAA and the RTAA. Coordination of this study between these agencies was accomplished in stages during the preparation of this Master Plan. Technical work was conducted by PBS&J, Inc. In addition, the general public that makes up the communities surrounding RTS, as well as the users and tenants of RTS, provided critical stakeholder input through surveys and at community meetings.

This Master Plan was prepared in accordance with FAA Advisory Circulars (AC) 150/5070-6B, *Airport Master Plans*, and AC 150/5300-13, *Airport Design, Change 12*, and other related federal standards. In addition, guidance was incorporated from the Nevada Department of Transportation (NDOT) Office of Aviation Planning, the RTAA, other concerned local government agencies, and is consistent with regional planning efforts such as the 2007 Regional Plan, 2030 Regional Transportation Plan, the North Valleys Regional Plan and the Washoe County Consensus Forecast. Prior planning studies and reports regarding RTS and/or the local community, developed within the past 15 years, were used as supporting materials. Those documents are also listed in Appendix A.

1.3 SUMMARY AND RECOMMENDATIONS

The Master Plan program is outlined and documented in detail in Chapter 8 Capital Improvement Program. It is presented in three phases: Phase I covers the short-term five-year period through 2013; Phase II covers the intermediate period through 2018; and Phase III covers the long-term period through 2028.

The major development items include:

Phase I

- Displacement of the Runway 26 threshold by 314 feet, application of declared distances and completion of grading work for runway safety compliance
- Relocation of the end of Runway 32 by 320 feet, application of declared distances and completion of grading work beyond pavement edge for runway safety area compliance
- Construction of new terminal building and adequate vehicle parking for terminal facilities
- Expansion of itinerant aircraft parking area with additional tie down markings and hardware to the west of existing apron by 28 positions
- Widening and strengthening of Taxiway D, which is currently designed to Group II standards, to comply with Group III standards

Phase II

- Construction of new air traffic control tower within Federal Aviation Administration contract tower program
- Installation of instrument landing system and approach lighting system for Runway 26

Phase III

- Rehabilitation of the closed taxiway connecting the north end of Taxiway D with Taxiway C to comply with Group III standards
- Construction of additional parallel taxiways along both runways to provide dual parallel taxiways
- Expansion of based aircraft hangar area to the west of existing hangar development by 54 hangars

Cost estimates for the phased implementation of the entire 20-year development program can be found in Chapter 8 Capital Improvement Program. Some of the projects may be eligible for FAA funding through General Aviation entitlement and Airport Improvement Program discretionary funding. Additionally the cost of the most expensive project, the construction of stormwater drainage improvements, would likely be shared with the local jurisdictions as well as future developers and tenants since mitigation is only required as development of the area occurs and would also provide a regional solution for stormwater drainage in the Stead area.

INVENTORY OF EXISTING FACILITIES

Reno-Stead Airport

2

2.1 GENERAL OVERVIEW

An inventory of airport facilities is essential to the success of a master plan, in that it provides the background information necessary for the remaining portions of the study. The inventory task for the Reno-Stead Airport (RTS) was accomplished through: physical review of facilities, field interviews, tenant surveys, and review of appropriate airport management records. Additional information was obtained from documents and studies about RTS and the local community.

This section provides a general description of the existing airport facilities. It also describes data relevant to the airport's history, geographic locale, climate, and operational role in the aviation system.

2.2 AIRPORT DESCRIPTION

RTS is located approximately ten miles northwest of the central business district of the City of Reno, Nevada. This general aviation (GA) airport, which consists of 5,170 acres, is located in the Stead community within the North Valley area of Washoe County, but still falls primarily within the City of Reno's jurisdiction for land use and zoning control. **Figure 2-1** illustrates the location of RTS within Nevada and **Figure 2-2** depicts RTS in relation to the surrounding community. RTS is owned and operated by the Reno-Tahoe Airport Authority (RTAA) and is the designated general aviation reliever airport for Reno-Tahoe International Airport (RNO), which is located approximately 11 miles to the southeast. RTS currently provides a full range of private, corporate, and flight training aviation services to the northern Nevada and California areas.

U.S. Highway 395 and Interstate 80 are the two major highways in Northern Nevada that pass through the Reno area. U.S. Highway 395 is the main connection to the ancillary roads leading to RTS. U.S. Highway 395 is approximately three miles south of RTS.

2.3 HISTORY

RTS began as the Reno Army Airbase. RTS was originally constructed in 1942 as a training center for enlisted officers and men newly assigned to the Signal Corps. Authority of the base was transferred to the Ferry Division of the Air Transportation Command in October 1943. The Air Transportation Command-Ferry Division was fully functional until the base's deactivation in 1945.

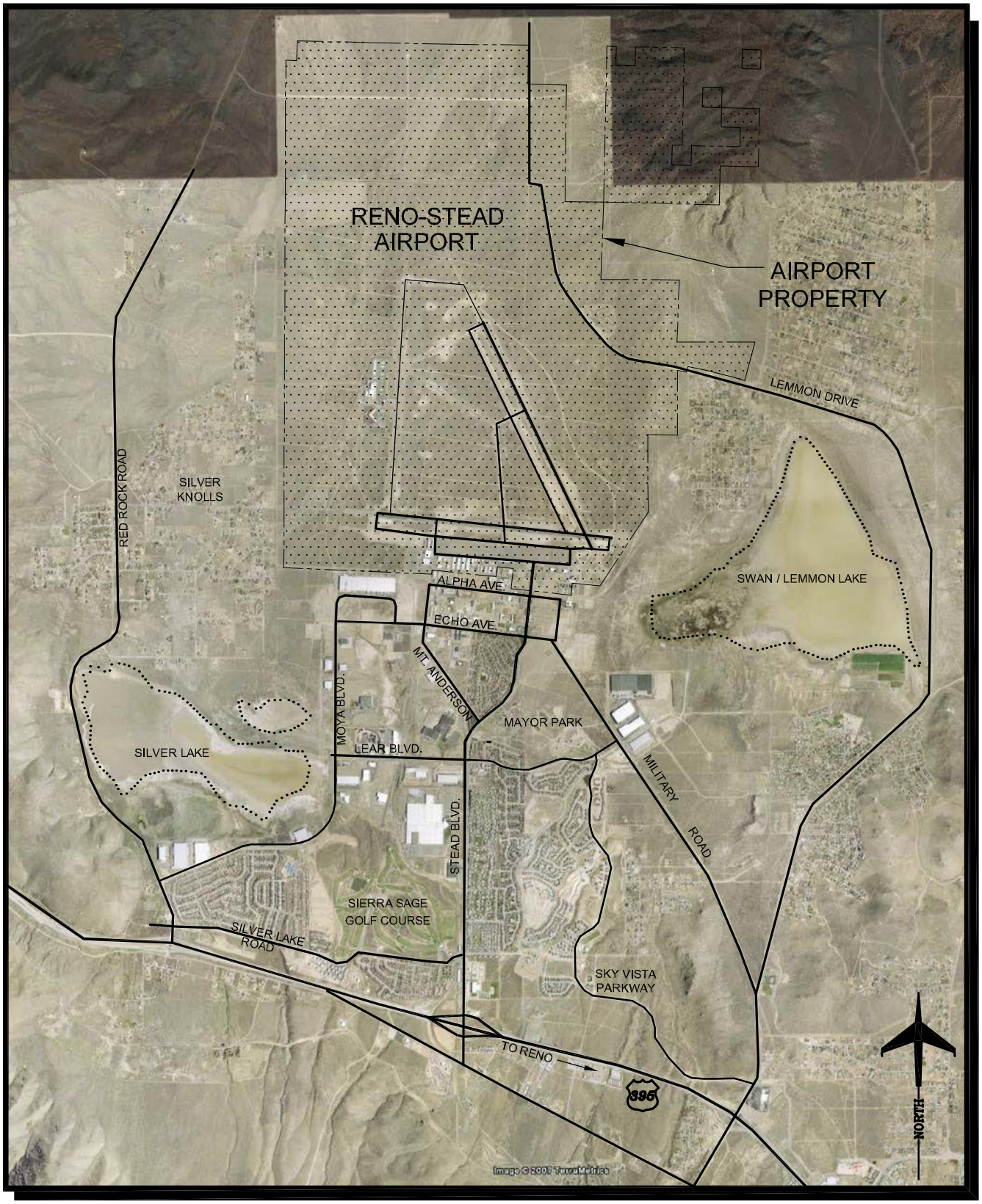
The vacant base was reactivated for training purposes in April 1948 and was used by the Nevada Army National Guard – 192nd Fighter Squadron. Almost two years after the base was reactivated, in the winter of 1949, Lt. Croston Stead was killed while engaged in a training exercise. In January of 1951, to commemorate the lieutenant and his achievements, the base was renamed Stead Air Force Base.

Source: Google Maps, PBSJ, 2007

LOCATION MAP

PBSJ	Master Plan Update Reno-Stead Airport Reno, Nevada	Location Map	Figure 2-1

Plotted By: 11328
J:\AVServ\071889.00 Reno MP\Master Plan Update\Chapter 2 Graphics_Fig2-01_Location Map.dwg Nov29,2007 - 1:07pm



Source: Existing ALP, PBSJ, 2007
Google Earth

VICINITY MAP

PBSJ	Master Plan Update Reno-Stead Airport Reno, Nevada	Vicinity Map	Figure 2-2

Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 2_Fig2-02-Vicinity Map.dwg Mar29,2010 - 1:02pm

The Stead Air Force Base was formally activated in 1952. During the period of 1952 through 1963, the Base was used as a military training center by the Air Force, Navy, Marines, foreign officers, and most of the pre-1965 astronauts. From 1952 to 1958 the United States Air Force Survival School also occupied the Base for training purposes. After 1958, the Base was placed on an inactive status. However, other branches of the military and other federal agencies continued to use the Base for training.

Stead Air Force Base, along with several other military fields throughout the United States, was closed in 1963. It was not until 1966 that Stead Air Force Base was quit claim deeded to the City of Reno. In June of 1966, the former Stead Air Force Base began operation as Reno-Stead Airport.

The distance between the City of Reno and the former base's existing development made it difficult to incorporate and transfer the City's newly acquired property due to legislation prohibiting annexation in non-contiguous areas. In 1968, once legislation was passed to allow annexation in non-contiguous areas, complete incorporation of the base property within the City of Reno was finalized. The airport property, which was a total of 2,300 acres, was subsequently transferred to the Airport Authority of Washoe County in June of 1979.

Several land acquisitions were made by the Airport Authority from 1978 to the present. The first acquisition was the 2,300-acre transfer of ownership pursuant to state enabling legislation, which was followed by the attainment of 600 acres from the Lear Family Trust seven years later. The next land purchase included 2,081 acres in the northern quadrant of the airport in support of the National Championship Air Races and Air Show. The most recent property acquisition involved 125 acres in the northeast quadrant purchased in 2009. RTS currently includes 5,170 acres of land and is operated by the Reno-Tahoe Airport Authority (formerly the Airport Authority of Washoe County, which was renamed on July 1, 2005). All day-to-day activities are administered by RTAA staff.

2.4 AIRSIDE FACILITIES

2.4.1 Runways

There are currently two runways serving RTS. Runway 14-32 is 9,000 feet long, 150 feet wide, and in excellent condition because a full reconstruction of the runway was completed in 2005. The runway is oriented in a northwest to southeast direction with an asphalt surface and load-bearing capacity of 75,000 pounds for single-wheel aircraft, 200,000 pounds for dual-wheel aircraft, and 320,000 pounds for dual-tandem-wheel aircraft. The runway currently complies with the standards specified in Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5300-13, *Airport Design, Change 12* for airport reference code (ARC) C-III aircraft and has precision runway markings. The threshold to Runway 32 has been displaced by 1,200 feet so landings in that direction have 7,800 feet of usable runway while all other operations on this runway make use of the full 9,000 feet available.

Runway 8-26 is oriented in a generally east to west direction and is 7,608 feet long and 150 feet wide. The runway is in good condition and consists of an asphalt surface with a load bearing capacity of 60,000 pounds for single-wheel aircraft, 100,000 pounds for dual-wheel aircraft and 150,000 pounds for dual-tandem-wheel aircraft. Runway 8-26 has non-precision markings and is the predominantly used runway at RTS.

Figure 2-3 illustrates the orientation of Runways 14-32 and 8-26.The overall characteristics of these runways are listed in **Table 2-1**.

Property Line

NORTH

0 600' 1,200' 2,400'

PBS&J®

Reno-Tahoe Airport Authority
P.O. Box 12490
Reno, Nevada 89510
Phone: 775-328-6400
Fax: 775-328-6510

Master Plan Update
Reno-Stead Airport
Reno, Nevada

Existing Airside Facilities

Figure
2-3

Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 2_Fig2-03_2-04-Existing Facilities.dwg Mar29,2010 - 3:42pm

Table 2-1. Runway Specifications

Dimensions	Runway 8-26	Runway 14-32
Length (feet)	7,608	9,000
Width (feet)	150	150
Surface Material	Asphalt	Asphalt
Surface Treatment	Grooved	Grooved
Load Bearing Capacity by Gear Type		
SWL (pounds)	60,000	75,000
DWL (pounds)	100,000	200,000
DTW (pounds)	150,000	320,000
Approach Slope	20:1; 20:1	20:1; 50:1
Effective Gradient	0.77%	0.05%

Runway End Coordinates	Runway 8	Runway 26	Runway 14	Runway 32
Latitude	39 39' 51.6400"N	39 39'43.9100"N	39 41'00.2189"N	39 39' 40.5500"N
Longitude	119 53 31.8800"W	119 51' 55.1400"W	119 52' 53.7750" W	119 52' 02.5700"W

Source: FAA 5010 Form and 2006 Airport Layout Plan (ALP).

2.4.2 Taxiways

The existing taxiway system at RTS, illustrated in Figure 2-3, connects all runway ends to the terminal area and other airport facilities. Runway 14-32 is served by parallel Taxiway B, which extends from the Runway 14 end to the Runway 32 end. Taxiway B is 50 feet wide and has 400 feet of separation from the Runway 14-32 centerline. The 400 feet of separation and 50-foot width meets FAA Airplane Design Group (ADG) III requirements.

Runway 8-26 is served by parallel Taxiway A on the south side of the runway, adjacent to the apron. Taxiway A is 50 feet wide and has a runway centerline to taxiway centerline separation of 520 feet. Taxiway A meets and exceeds FAA ADG Group III standards.

Taxiway C is located in the middle of the airfield between Runway 14-32 and Runway 8-26 and provides service to both runways. Taxiway C connects to Taxiway B and Taxiway A. Taxiway D connects the Nevada Army National Guard building to Taxiway A.

Both Taxiway A and Taxiway B have several entrance/exit taxiways that connect the parallel taxiway to the runway at various locations. This network of taxiways permits the safe and efficient movement of aircraft around the airfield.

2.4.3 Aircraft Parking Apron

There is one public accessible aircraft parking apron located at RTS. The apron is located directly south of Runway 8-26. The parking apron is approximately 215,000 square yards; 204,000 square yards of this area is paved with asphalt. The remaining parking area is paved with concrete for larger aircraft parking. The asphalt ramp is estimated to have a strength of 20,000 pounds single-wheel load based on historical records; however, no pavement strength testing has been completed.

Temporary grandstands that are used for the National Championship Air Races and Air Show are located generally in the center of the apron area, north of the intersection of

Texas Avenue and Mt. Lola Street, on the south portion of the apron pavement. Two general tie-down areas are located on either side of the grandstands; the one to the east is used by both itinerant and based aircraft while the one to the west is used exclusively by based aircraft. Other aircraft parking areas are designated on the apron and airfield; however, these are mainly used during the National Championship Air Races and Air Show or to stage firefighting aircraft during operations by the Bureau of Land Management (BLM) firefighting support base. The aircraft parking apron is illustrated in **Figure 2-4.**

2.5 METEOROLOGICAL CONDITIONS

Aircraft operations at airports are affected by weather patterns and associated regional meteorological conditions. The amount of rainfall, prevailing wind direction, and average amount of inclement weather all work to determine the runway orientation, instrument approach requirements, and navigational aids (NAVAIDS) required to achieve the safest and most efficient operation possible.

2.5.1 Climate

Reno is located at the west edge of the Great Basin in a semi-arid plateau. The average annual precipitation in the region is 7.5 inches. The December to March period in Reno produces over half of the area's precipitation, which is deposited in the form of mixed rain and snow. Humidity is low during the summer and winter months. The average daily temperature is mild; however, the difference between daily highs and lows often exceeds 45 degrees Fahrenheit (°F). The average annual temperature in Reno is 50.8 °F. The annual monthly average high temperature is 89.6 °F and the annual monthly average low temperature is 21.9 °F.

2.5.2 Wind

The prevailing winds at RTS are generally out of the west, making Runway 8-26 the predominantly used runway. Because of its proximity to most of the existing development at RTS, Runway 8-26 is also the preferred runway during calm wind conditions. Short periods of strong winds out of the south-southwest, which create crosswind conditions with the existing runway configuration, have also been noted through tenant interviews and review of the wind rose data. **Figure 2-5** illustrates the wind rose for RTS. The existing runway layout of RTS exceeds the FAA required 95 percent wind coverage.

2.6 FACILITY DESIGN CRITERIA

The FAA AC 150/5300-13, *Airport Design*, provides the ARC system in order to coordinate airport design criteria with characteristics of the critical aircraft type intended to operate at an airport. Two separate components comprise the ARC: aircraft approach category and the ADG. The aircraft approach category is an operational characteristic relating to the approach speed of an aircraft. Specifically, the approach categories are based on a factor of 1.3 times the aircraft stall speed in landing configuration at maximum certificated landing weight. Approach categories are represented by a letter designation, as depicted in **Table 2-2**.

BUILDINGS/FACILITIES		
EXISTING	DESCRIPTION	ELEVATION (NAVD 88)
1	BLM FIRE TANKER BASE	5058.6
2	RTAA FUEL FARM	5046.5
3	RTAA MAINTENANCE FACILITY	5065.8
4	RTAA STORAGE UNITS	5046.9
5	AIRPORT LIGHTING VAULT	5046.3
6	AIRCRAFT HANGAR (ACL)	5071.9
7	AIRCRAFT HANGAR (ACL)	5067.6
8	AIRPORT MANAGER'S OFFICE	5036.7
9	ATC TOWER & ROTATING BEACON	5104.8
11	RENO AIR RACE ASSOC. GRANDSTANDS	5068.1
13	PILOT LOUNGE	5037.4
14	FUEL ISLAND	5038.7
15	T-HANGARS	5043.8
16	T-HANGARS	5051.6
17	T-HANGARS	5036.1
18	RENO AIR RACE ASSOC. HANGARS	5054.3
19	RENO AIR RACE ASSOC. HANGARS	5046.3
20	RENO AIR RACE ASSOC. HANGARS	5055.3
21	T-HANGARS	5039.6
22	KANE KLASSIC T-HANGARS	5043.8
23	T-HANGARS	5029.2
24	T-HANGARS	5033.3
25	T-HANGARS	5030.6
26	WASH RACK AND PUBLIC RESTROOM	5025.5
27	AIRCRAFT HANGARS	
28	T-HANGARS	5037.1
29	T-HANGARS	5040.8
30	T-HANGARS	5039.4
31	T-HANGARS	5031.8
32	T-HANGARS	5036.9
33	T-HANGARS	5034.0
34	T-HANGARS	5028.6
35	HANGAR	
35A	HANGAR	
36	HANGAR	5036.9
37	AIRCRAFT HANGAR (LAN-DALE)	5024.0
38	AIRCRAFT HANGAR (NETWORK)	5023.0
39	RENO AIR RACE ASSOC. HANGAR	5024.5
40	AIRCRAFT HANGAR (RARA)	5034.5
41	T-HANGARS	5018.1
42	T-HANGARS	5019.4
43	T-HANGARS	5019.5

— - - - — Property Line

NORTH

0 250' 500' 1,000'

N 14915977.57
E 2257630.85

19 20
30 29
N 14915480.36
E 2258452.71

N 14915484.83
E 2260616.0

AWOS

N 14915608.31
E 2262188.69

ILS Critical Area

TAXIWAY "B"

ABANDONED TAXIWAY

TAXIWAY "A"

TAXIWAY "A3"

TAXIWAY "A2"

TAXIWAY "A"

TEXAS AVE

ALPHA AVE

PETRICCIANI WAY

FLORIDA

MARYLAND

BRAVO AVENUE

COCOA AVE.

MT. ANDERSON

MT. MCCLELLAN

MT. BISMARK

MT. LOLA

MT. CHARLESTON

MT. VIDA

MAHANNA

MT. BULLION

MT. LIMBO

ECHO AVE.

UNI

PBS&J®

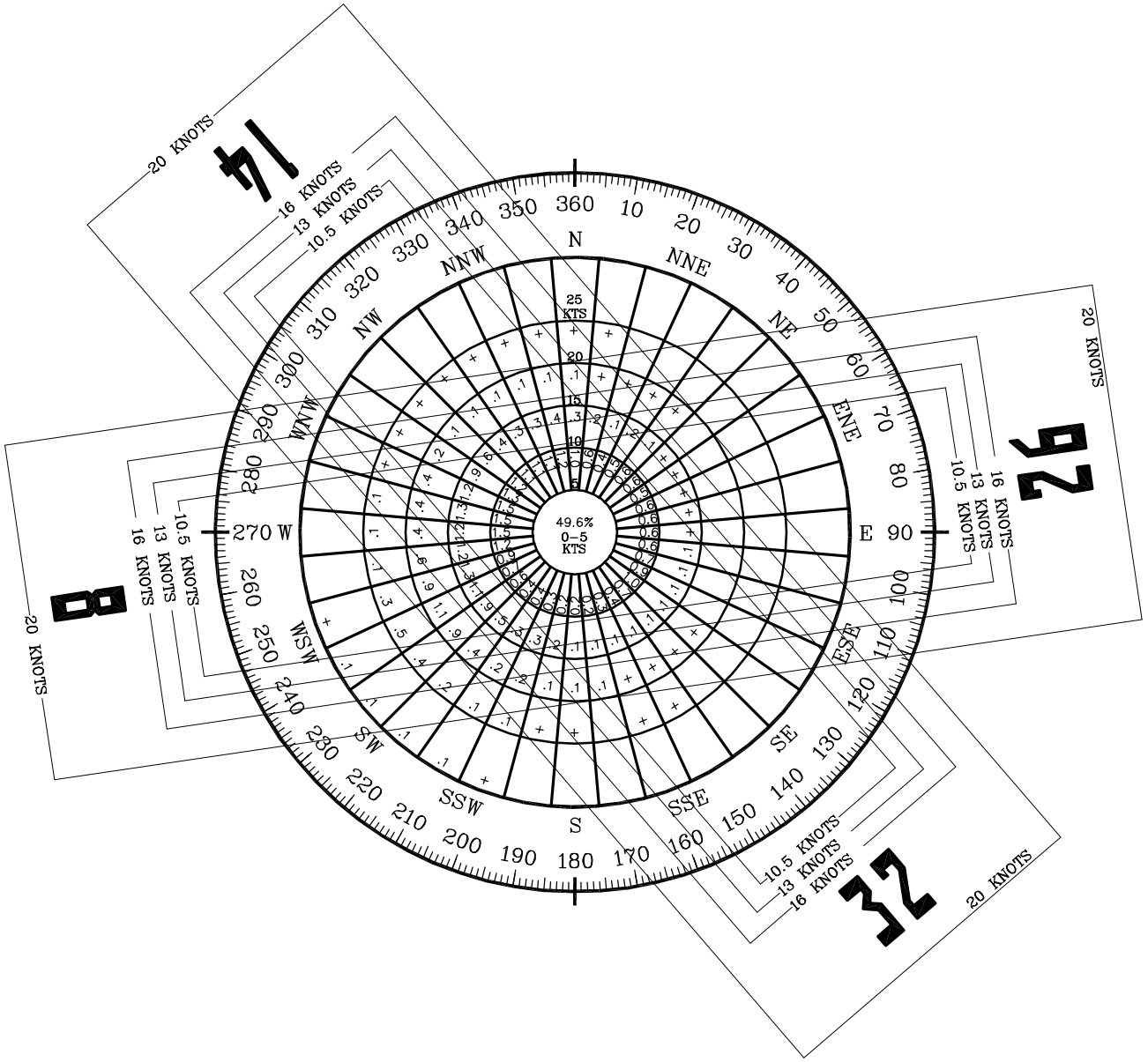
Reno-Tahoe Airport Authority
P.O. Box 12490
Reno, Nevada 89510
Phone: 775-328-6400
Fax: 775-328-6510

Master Plan Update
Reno-Stead Airport
Reno, Nevada

Existing Apron and Terminal Area

Figure 2-4

Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 2_Fig2-03_2-04-Existing Facilities.dwg Mar29,2010 - 3:42pm



ALL WEATHER WIND ROSE TABLE				
	10.5 KNOTS	13 KNOTS	16 KNOTS	20 KNOTS
Runway 14-32	*86.71%*	*91.06%*	*95.45%*	*97.98%*
Runway 8-26	*93.05%*	*96.22%*	*98.00%*	*99.58%*
Combined Coverage	*96.13%*	*97.63%*	*98.89%*	*99.68%*

SOURCE:
Western Region Climate Center
DRI Sage building
2215 Raggio Parkway
Reno, Nevada 89512

OBSERVATIONS:
337,390 Observations
1997-2004

PBS&J

Master Plan Update
Reno-Stead Airport
Reno, Nevada

All Weather
Wind Rose

Figure
2-5

Plotted By: 11328
J:\AVServ\071889.00 Reno MP\Master Plan Update\Chapter 2 Graphics_Fig2-05-WindRose.dwg Nov29,2007 - 2:51pm

Table 2-2. Aircraft Approach Speed Categories

Category	Speed
Category A	Speed less than 91 knots
Category B	Speed 91 knots or more, but less than 121 knots
Category C	Speed 121 knots or more, but less than 141 knots
Category D	Speed 141 knots or more, but less than 166 knots
Category E	Speed 166 knots or more

The ADG is a physical characteristic defined by an aircraft's wingspan. While approach speeds only affect runway design, wingspan affects the design and separation of runways, taxiways, taxilanes, and aprons. A Roman numeral depicts the ADG, as described in the following table.

Table 2-3. Airplane Design Group by Wingspan

Group	Wingspan
Group I	Up to, but not including 49 feet
Group II	49 ft up to, but not including 79 feet
Group III	79 ft up to, but not including 118 feet
Group IV	118 ft up to, but not including 171 feet
Group V	171 ft up to, but not including 214 feet
Group VI	214 ft up to, but not including 262 feet

Airfield improvements are implemented according to the established ARC for the critical or most demanding aircraft expected to utilize an airport or particular runway. The current ARC for RTS is C-III. Some typical C-III aircraft include: the Airbus 320, Boeing 737, MD-80, MD-90 and Boeing 717.

2.7 NAVIGATIONAL AIDS

NAVAIDS are designed to assist pilots and air traffic controllers in maximizing the safe and efficient use of an airport under different meteorological conditions. NAVAIDS refer to any facility available for use in the aid of air navigation. NAVAIDS include lights or any apparatus or equipment used for disseminating weather information, signaling, radio direction finding, or electronic communication. Any other structure or mechanism having a similar purpose for guiding or controlling flight in the air and/or the landing or takeoff of aircraft is also considered a NAVAID. It must be noted that regardless of the level of NAVAIDS provided at RTS, it is likely there will be short periods of time during certain meteorological conditions (e.g, fog, snow, icing, high winds) when aircraft will be unable to utilize RTS.

2.7.1 Enroute Navigational Aids

Enroute NAVAIDS are designed to assist pilots with navigation between their origin and destination airports. These NAVAIDS consist of ground-based transmission facilities and receiving instrumentation onboard aircraft. Two enroute NAVAIDS operate in the Reno area.

The Very High Frequency Omni-Directional Range (VOR) is a ground based NAVAID that transmits high frequency radio signals in all 360 degree compass headings from the station. These radio signals allow a pilot fly along a heading leading to or away from the station. VOR stations are often combined with Distance Measuring Equipment (DME) or Tactical Air Navigation (TACAN) capabilities. Both devices emit signals enabling pilots to determine their line of site distance from the VOR station. The TACAN also provides azimuth information for military aircraft. Pilots flying to and from RTS may use the Mustang VORTAC (VOR and TACAN) and/or the Squaw Valley VOR-DME (VOR and DME). The Mustang VORTAC is approximately 13 nautical miles southeast of RTS. Squaw Valley VOR-DME is located 34.4 nautical miles southwest of RTS.

2.7.2 Terminal Area Navigation and Landing Aids

Terminal area navigation and landing aids are used to assist pilots during aircraft landings and take-offs. The terminal area NAVAIDS and landing aids at RTS include: Precision Approach Path Indicators (PAPIs), lighted windsocks, a lighted segmented circle, and an Instrument Landing System (ILS) on Runway 32.

A PAPI is a light system positioned beside a runway and consists of two to four light boxes that provide a visual indication of an aircraft's position on the approach glide slope for the associated runway. The existing PAPIs at RTS are four-light PAPI systems located on the left side of all four runway ends and can be seen up to five miles during the day and 20 miles at night. Each light of the PAPI is equipped with a lens that splits light output into two segments, red and white. A typical four-light system displays two white lights and two red lights when aircraft are flying on the appropriate approach glide slope. The system displays three red lights and one white light for aircraft flying slightly below the appropriate glide slope and all red lights for aircraft flying well below the glide slope. When aircraft are flying above the appropriate approach glide slope the system displays three white lights and one red light for slightly above and all white lights to those flying well above the glide slope.

A lighted windsock is a landing aid that indicates wind direction and is typically located near the touchdown zone of the runway. There are a total of three lighted windsocks at RTS. The windsock near the intersection of Runways 32 and 26, which is located on the southeast portion of the airfield adjacent to Taxiway A, consists of a windsock combined with a lighted segmented circle. The segmented circle is typically used to help identify the location of the wind direction indicator and will have extensions on the circle if the airport traffic pattern is other than a standard left-hand pattern, which is the case for Runway 26.

An ILS is an instrument approach system that provides electronic horizontal and vertical guidance to aircraft approaching a runway. The ILS typically consists of a localizer (horizontal guidance) transmitter, a glide slope (vertical guidance) transmitter, an outer marker or non-directional beacon (distance guidance), and an approach lighting system (e.g. medium intensity approach light system with runway alignment indicator lights [MALSR]). An ILS is on Runway 32 at RTS. The addition of ILS capabilities at RTS improves the safety and overall availability of RTS during inclement weather for aircraft operations.

2.7.3 Airport Lighting Aids

Airport lighting aids assist pilots in the identification of an airport facility and while maneuvering on the airfield. The existing lighting aids at RTS include a rotating beacon, runway end identification lights, and runway and taxiway edge lights.

A rotating beacon helps approaching pilots identify the location of an airport from a distance at night or during periods of reduced visibility. Rotating beacons that emit alternating flashes of one green and one white light identify civilian-use land airports such as RTS. Rotating beacons are generally in use from dusk to dawn, and when weather conditions deteriorate to a ceiling of less than 1,000 feet and visibility less than three miles, resulting in Instrument Flight Rules conditions (IFR or Instrument Flight Rules are regulations and procedures for flying aircraft whereby navigation and obstacle clearance is maintained with reference to aircraft instruments only and separation from other aircraft is provided by Air Traffic Control). The rotating beacon at RTS is located on top of the Air Traffic Control Tower (ATCT), directly south of the aircraft parking apron and east of Iowa Street.

Runway End Identifier Lights (REILs) are installed to give pilots positive visual identification of the physical end of the runway when approaching an airport. REILs are located on both ends of Runway 14-32 and Runway 8-26 at RTS.

Runway and taxiway lighting systems are used to identify the runway or taxiway pavement edges and aid pilots during landing, takeoff, and/or taxi operations at night or in inclement weather. In order to assist pilots in distinguishing between runways and taxiways, runway lighting is white and taxiway edge lighting is blue. Runway 14-32 and Runway 8-26 are both equipped with High Intensity Runway Lights (HIRLs). Pilots may use the Unicom/Common Traffic Advisory Frequency (CTAF) on 122.7 megahertz (Mhz) in order to self-activate the HIRLs and REILs at RTS. There is currently Medium Intensity Taxiway Lighting (MITL) on Taxiways A and B at RTS. No taxiway lighting exists on Taxiways C or D.

2.8 EXISTING LANDSIDE FACILITIES

2.8.1 Terminal Facility

The existing terminal facility is located on the south side of Runway 8-26, just east of the airport manager's office. The terminal facility is a modular structure and is approximately 1,700 square feet. The existing facility is largely for pilot use and consists of restrooms, storage facilities, a pilot lounge, and a flight planning area. Figure 2-4 depicts the location of the existing terminal/pilot facility.

2.8.2 Aircraft Hangars

There are several aircraft hangar facilities located on RTS. The hangars include a small number of T-Hangars and a significant number of small and large conventional hangars. All existing aircraft hangars are located in proximity to the aircraft parking apron and have direct access to Taxiway A. Based on the current Airport Layout Plan (ALP), 102 aircraft hangars exist on RTS. The majority of the hangars are privately owned and constructed on land leased from the RTAA. The RTAA recently completed construction of three new taxilanes on the southwest side of the airfield specifically for the development of additional aircraft storage hangars at RTS. Through a request for proposals selection process the RTAA has chosen a developer to construct the new hangars. The developer, Silver Pacific Aviation, LLC, has proposed to ultimately place 60 new hangar units on this property. Figure 2-4 depicts the location of all aircraft hangar facilities.

2.8.3 Fixed Base Operator

The fixed base operator (FBO) at RTS is Aviation Classics. Aviation Classics is a full-service FBO offering a wide variety of services, including, but not limited to:

- Aviation fuel (100 low lead and Jet A)
- Self-serve fuel (100 low lead)
- Major and minor maintenance (including Avionics, power plant and airframe)
- Tie-down space
- Restrooms
- Pilot supplies
- Hangar rental
- Used aircraft sales
- Weather and flight planning facilities

The location of the FBO facilities is shown previously in Figure 2-4.

2.8.4 National Championship Air Races and Air Show – Reno Air Racing Association

The National Championship Air Races and Air Show are held annually at RTS. It is a ten-day event held annually in September, featuring multi-lap, multi-aircraft races between high performance aircraft on closed courses that range from 3.18 miles to 8.48 miles in length.

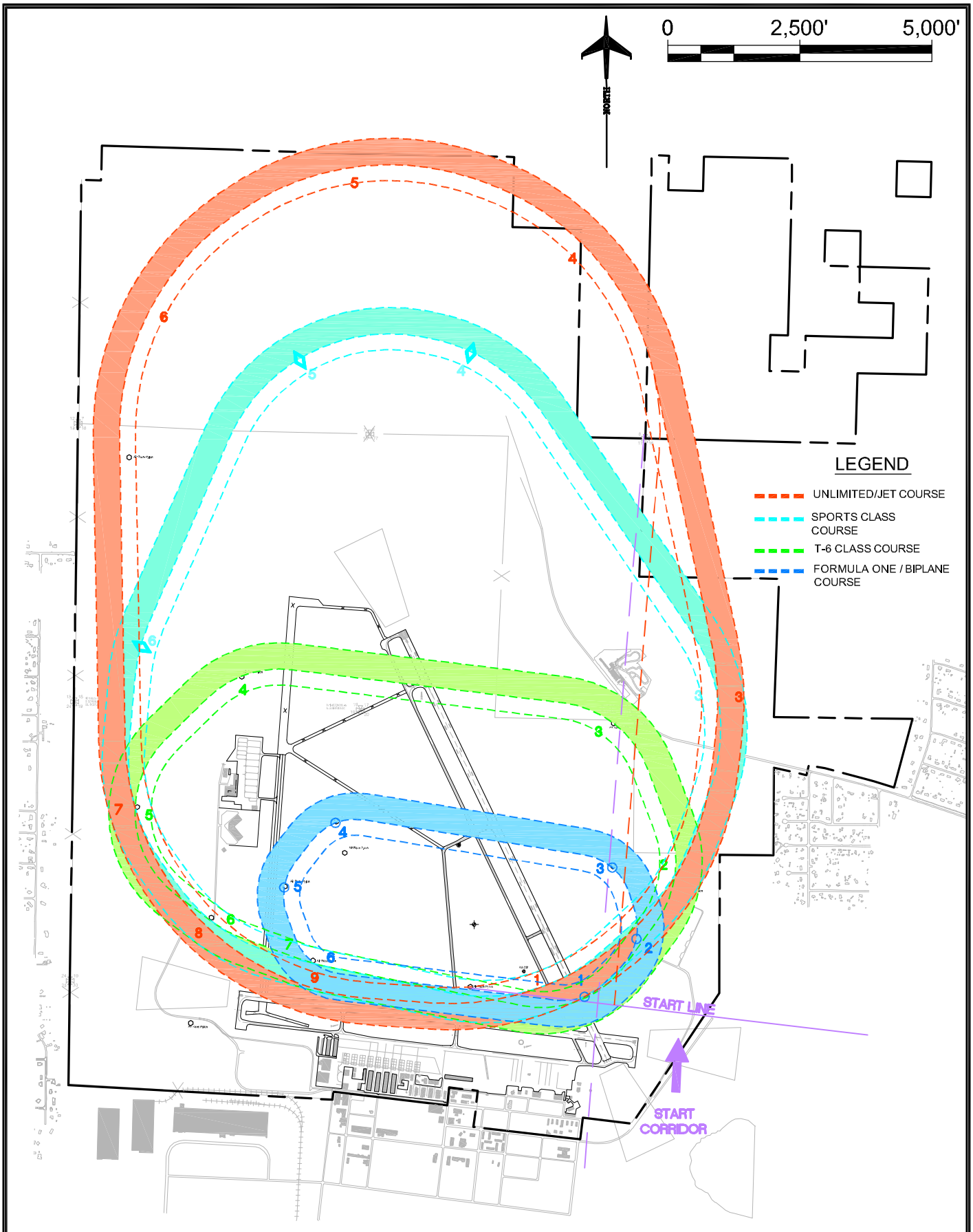
Pilots require special certifications to compete in the National Championship Air Races. The Pylon Racing Seminar is a 3-day certificated course offered annually in June. The seminar allows race pilots to become prepared, experienced, and certified to enter the National Championship Air Races. Courses offered during the seminar include; Ground School, Formation Flying, and Reno Pylon Race Practice Flying. Upon completion of the necessary courses, a check ride by an FAA-certified race Class Check Pilot must be successfully completed in order to compete in the races.

Both the Pylon Racing Seminar and the National Championship Air Races are sponsored by the Reno Air Racing Association (RARA). The four general race courses for the National Championship Races and Air Show include the Unlimited/Jet Course, the Sports Class Course, the T-6 Class Course, and the Formula One/Biplane Course. The race courses are outlined by race pylons for the six race class categories. The six race classes are Biplane, T-6, Formula One, Sport, Jet, and Unlimited. In 2000, the race courses were modified to remain largely on-airport property. A safety area is required for each race course which varies in width based on the race class. **Figure 2-6** illustrates the four Air Race courses and the associated safety areas located at RTS.

RARA has six hangar facilities at RTS. Due to the size and impact of the annual event and associated race courses, RARA's operations play an important role in the future development of RTS.

2.8.5 Other Aviation Tenants

Other existing aviation service providers at RTS include two mechanical repair companies: J and J Aircraft Repair and American Air Racing, and three flight schools: High Sierra Aviation, Aerobatic Company and Flight School, Inc., and Ace Aviation. The Nevada Army National Guard, which is comprised of 14 rotary wing and one fixed wing aircraft, is also located on the airfield and has ground and/or facility leases with RTS. The rotary wing aircraft operated by the Nevada Army National Guard include; six CH-47D (Chinook), five UH-60A (Blackhawk) and three OH-58A/C's (Kiowa) helicopters. The fixed wing aircraft operated by the Nevada Army National Guard is a C-12 (King



Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 2_Fig2-06-Race Course.dwg Mar29,2010 - 1:43pm

PBS&J	Master Plan Update Reno-Stead Airport Reno, Nevada	Reno Air Race Courses	Figure 2-6

Air). The Nevada Army National Guard performs significant helicopter training operations on and in the vicinity of RTS. Additionally, the BLM has a fire base located on the east side of the airfield. The base serves all of Northern Nevada and several California counties. Typically there are three based aircraft (two air tractors and one Aero Commander) located at RTS. However, during the fire season (summer months) the base will typically receive several itinerant aircraft and will operate at significantly higher crew and aircraft levels if it is used as a base for local firefighting efforts. Future plans for the base include an expansion to accommodate additional crew facilities, retardant storage and aircraft parking.

2.8.6 Aircraft Rescue and Fire Fighting

Current FAA guidelines do not require RTS to have an Aircraft Rescue and Fire Fighting (ARFF) facility at the airfield. Fire Station #9, which is owned and operated by the City of Reno, is located less than one mile south of RTS, on Mount Vida Street.

2.8.7 Fuel Facilities

The aviation fuel farm facilities at RTS, located east of Maryland Road, are currently owned by the RTAA and leased to Aviation Classics. Existing fuel facilities include a 12,000-gallon above-ground Jet A fuel storage tank and two 12,000-gallon above-ground 100 low lead (LL) storage tanks. There is also a self-service fuel island, operated by Aviation Classics, located on the east end of the aircraft parking apron. The self-service island uses one 12,000-gallon 100LL tank for fuel storage.

Fuel is accessible 24 hours a day, seven days a week through the self-service fuel island. Fuel is also delivered to aircraft via two fuel trucks owned by Aviation Classics. The trucks consist of one 8,000-gallon truck containing Jet A fuel and one 8,000-gallon truck containing 100LL fuel. Figure 2-4 shows the location of the fuel farm and the self-serve island.

2.8.8 Automobile Parking and Ground Access

General automobile parking areas are located adjacent to the apron frontage road near the airport manager's office, terminal/pilot facility, and FBO facilities. Additional parking areas are also located near individual commercial tenants. These parking areas are largely used by airport tenants and their employees. A general public parking/viewing area is located along Petriccianni Street, west of the airport manager's office.

The primary highway ground access to RTS is from U.S. Highway 395. As stated earlier, RTS is approximately three miles north of this major highway, which runs through Spokane, Washington; Reno, Nevada; and San Bernadino, California. The major arterial road to RTS from U.S. Highway 395 is Stead Boulevard. Additional access roads to RTS include Moya Boulevard from Red Rock Road on the southwest side of the RTS and Military Road from Lemmon Drive on the southeast side of RTS. However, all of these access roads ultimately connect to U.S. Highway 395 to the south of RTS.

A rail spur from the Union Pacific Railroad line, located approximately four miles south of RTS, runs west of Stead Boulevard, north to RTS and terminates adjacent to the southwest property line. This spur is currently used to serve several off-airport industries that have been constructed and expanded in the area. However, it is anticipated that the rail spur could be extended to serve on-airport businesses in the future.

2.9 EXISTING ENVIRONMENTAL CONSIDERATIONS

Existing environmental conditions must be considered when planning for any development at an airport. The most significant environmental issues that could affect airport development at RTS include aircraft noise, drainage patterns, water quality and supply, topography, and existing hazardous waste monitoring sites. The following section serves as a brief overview of the existing environmental conditions that should be examined, at a minimum, in conjunction with future development planning and construction projects at RTS.

2.9.1 Aircraft Noise

Noise is typically the most apparent impact that an airport has on the environment. The FAA uses the average Day-Night Sound Level (DNL) in decibel values as the national standard for measuring airport noise. The FAA has determined that a sound level of 65 DNL or less is compatible with residential and other noise sensitive land uses. Noise levels higher than 65 DNL are typically only compatible with more intense land uses, such as commercial and industrial uses.

RTS has seen some residential encroachment over the years, and as a result there is a potential for noise impacts that may be associated with future airport development that must be considered during any development planning efforts. Neighboring land uses around RTS are discussed later in Section 2.11.

2.9.2 Drainage Patterns

The eastern most portion of RTS drains to the southeast of the airport into Swan/Lemmon Lake. The majority of RTS drains to the south and southwest. Surface water drainage from the north of RTS originates in the hills and flows across the airport to the south-southwest, as there are no existing ponds or permanently wet channels within the airport boundaries. The natural drainage of RTS ultimately empties into either Silver Lake, to the southwest of RTS, or Swan/Lemmon Lake to the southeast of the airport. Any development on RTS may increase storm/surface drainage runoff and, therefore, will likely require drainage controls to avoid any increased flows into the neighboring communities. Consideration of these potential drainage requirements must be included in future planning and design concepts at RTS. Further discussion of future drainage requirements will be presented in Chapter 6 Drainage Master Plan.

2.9.3 Water Supply

RTS is located within two hydrological basins in the Lemmon Valley that are divided by the airport fault. It is believed that the airport fault is a barrier to groundwater flow through the region. Further, Lemmon Valley is a Designated Groundwater Basin, which means RTS is located in a hydrographic area where permitted groundwater rights are approaching or exceeding the estimated annual recharge of the area and no additional pumping is allowed.

Due to a higher demand for water than available supply, water importation has become an important method to provide necessary water supply. On October 16, 2007 the Washoe County Commissioners approved a water importation transfer agreement, allowing Washoe County to own, operate, and maintain the water importation infrastructure. The agreement allows approximately 8,000 acre feet per year (af/yr) of water to be pumped into the Stead/Lemmon Valley area. The water transmission pipeline associated with this project is about 28 miles long and extends from six production wells in the southeastern Honey Lake Valley southward through Dry Valley,

Bedell Flat and Antelope Valley, to a storage tank at the divide between Antelope Valley and Lemmon Valley.

RTS is currently within two water service districts, Truckee Meadows Water Authority (TMWA) and Washoe County. TMWA is responsible for the water supply to the existing airport facilities while the remaining area is within Washoe County's water service district. The Nevada Army National Guard facility at RTS is currently served by an on-site well. **Figure 2-7** illustrates the service areas of the two water utility providers.

The amount of unencumbered water rights owned by the RTAA available to support development at RTS is currently a total of 50 acre-feet. This level of available water rights would limit long-term development of RTS. The availability and cost of additional water rights will likely be a significant factor in future airport development and must be considered in the planning process.

2.9.4 Existing Hazardous Waste Monitoring Sites

RTS currently has two existing areas of soil and groundwater contamination in the southwest quadrant of the property. Since the originating source of the contamination could not be definitively identified, four separate entities executed a Consent Decree that assigned financial liabilities for cleanup of the property. The Consent Decree entities are the U.S. Army Corps of Engineers, RTAA, the Lear Entities, and the City of Reno. The remediation plan has been initiated and includes both extraction (ground water and vapor) and monitoring wells. To date the remediation plan is working well and contamination levels are steadily decreasing. Under the terms of the Consent Decree, new airport development that does not add to the contamination is not required to undertake any special clean-up efforts. However, future development within this area should consider the location of the existing extraction/monitoring wells and any potential impacts to the remediation program. **Figure 2-8** illustrates the contamination plume areas and well locations.

2.10 UTILITIES

Based on existing studies and records of utilities at RTS, the majority of the utilities were constructed in the 1940s and 50s by the military. Sanitary sewer is provided by the Reno Stead Waste Water Treatment Facility, which is owned by the City of Reno. The sanitary sewer lines that serve RTS are part of the original collection system installed by the military over 50 years ago. The majority of lines that service the existing airport buildings access RTS from a main line that runs east and west between Alpha Avenue and Bravo Avenue. However, portions of the existing sanitary sewer alignments are not completely documented.

As noted in Section 2.9.3, water is supplied to RTS by TMWA and Washoe County. The domestic water network enters RTS from the south off of Alpha Avenue. The network generally runs east to west along the southern edge of the apron in front of the hangar facilities. These water lines provide water supply to all of the airport facilities except the Nevada Army National Guard, which is served by an on-site well with its own water supply lines. No water lines are currently available on the majority of the west, north and eastern areas of RTS.

LEGEND

Truckee Meadows Water Authority (TMWA)

Water Services provided by Washoe County for all other areas.

TMWA WATER WELL

TMWA WATER WELL

ABANDONED TAXIWAY

ABANDONED RUNWAY

TAXIWAY "B"

ABANDONED TAXIWAY

150' X 9000' RUNWAY N 25° 34' 54" W (TRUE)

TAXIWAY "D"

ABANDONED TAXIWAY

TAXIWAY "B"

TAXIWAY "C"

TAXIWAY "C"

TAXIWAY "B"

TAXIWAY "D"

EXISTING 150' X 7,608' RUNWAY N 83° 15'29" W (TRUE)

TAXIWAY "A4"

Abandoned Taxiway

TAXIWAY "A"

TAXIWAY "A3"

TAXIWAY "A2"

TAXIWAY "A"

LEMMON VALLEY WEST SUB BASIN

LEMMON VALLEY EAST SUB BASIN

Calle Maria St

Industrial St

Cocoa Ave

NORTH

0 600' 1,200' 2,400'

Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 2_Fig2-07-Water Providers.dwg Dec15,2009 - 11:50am

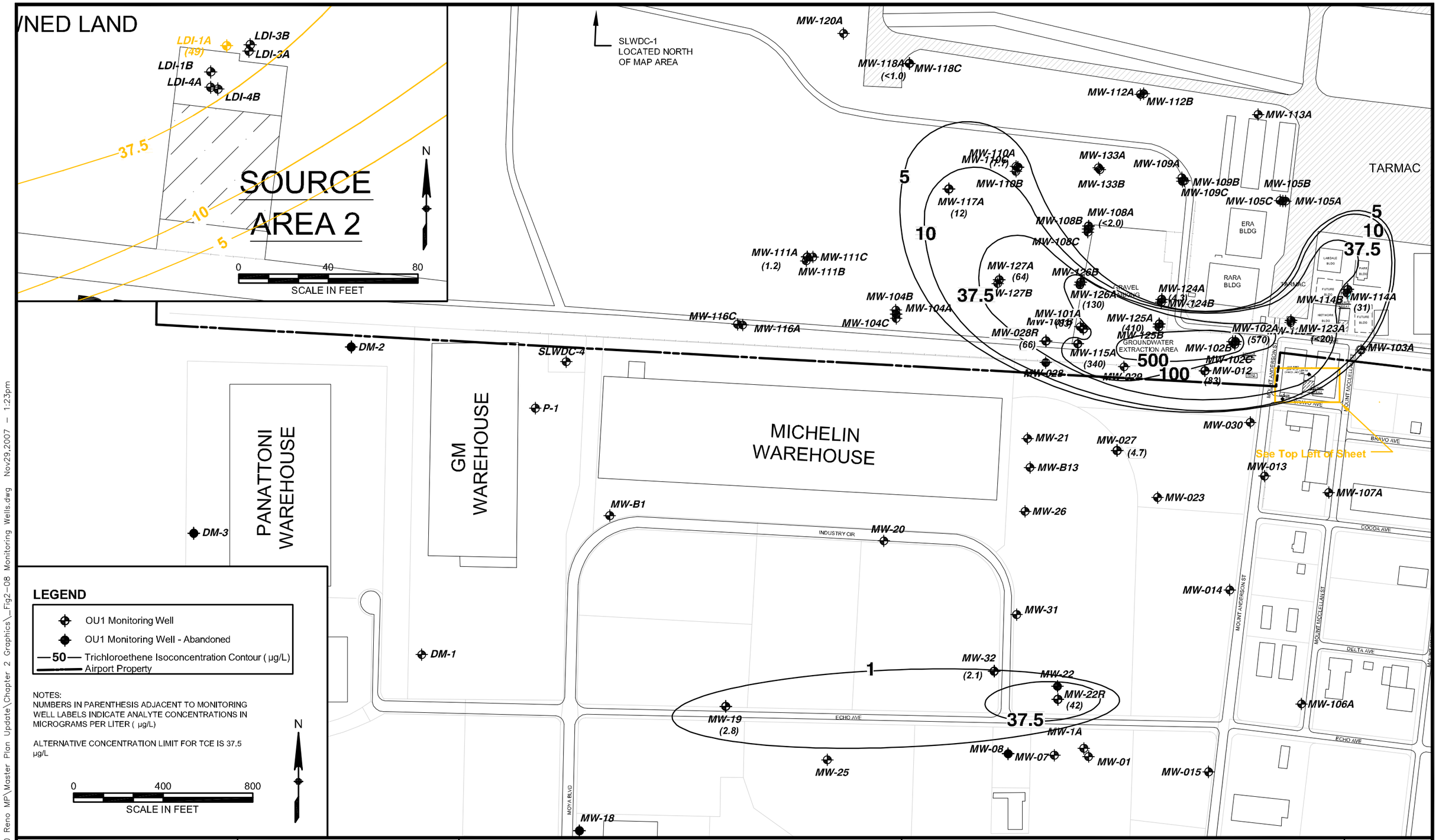
PBS&J

Reno-Tahoe Airport Authority
P.O. Box 12490
Reno, Nevada 89510
Phone: 775-328-6400
Fax: 775-328-6510

Master Plan Update
Reno-Stead Airport
Reno, Nevada

Water Utility Providers
Service Districts

Figure
2-7



Plotted By: 11328 J:\AVServ\071889.00 Reno MP\Master Plan Update\Chapter 2 Graphics_Fig2-08 Monitoring Wells.dwg Nov29,2007 - 1:23pm

PBS&J

Reno-Tahoe Airport Authority
P.O. Box 12490
Reno, Nevada 89510
Phone: 775-328-6400
Fax: 775-328-6510

Master Plan Update
Reno-Stead Airport
Reno, Nevada

Ground Water Plume Contamination Areas and Monitoring Well Locations

Figure 2-8

Natural gas and electrical supply are provided to RTS by the NVEnergy. NVEnergy currently has plans to construct a 120 kilo volt (kv) power Transmission line that will pass along the northern and western boundaries of RTS. The new NVEnergy power lines will extend 34 miles starting at the Tracy Lake Power Plant, running through Spanish Springs, around RTS, and ending at the Silver Lake Substation. The proposed action will result in the construction of two new electrical substations one of which will be located at the northwest corner of RTS which can then be used for distribution of power within the airport property. **Figure 2-9** illustrates the location of the selected Tracy/Silver Lake Transmission Line Agreement in the vicinity of RTS.

Natural gas lines at RTS generally run east and west along Texas Avenue and Alpha Avenue and access the airport facilities from these locations. Also, a gas line runs north and south along the majority of the west property line and provides service to the western area of RTS and Nevada Army National Guard facility. Electric service lines run throughout the southern portion of RTS and largely provide service through overhead lines.

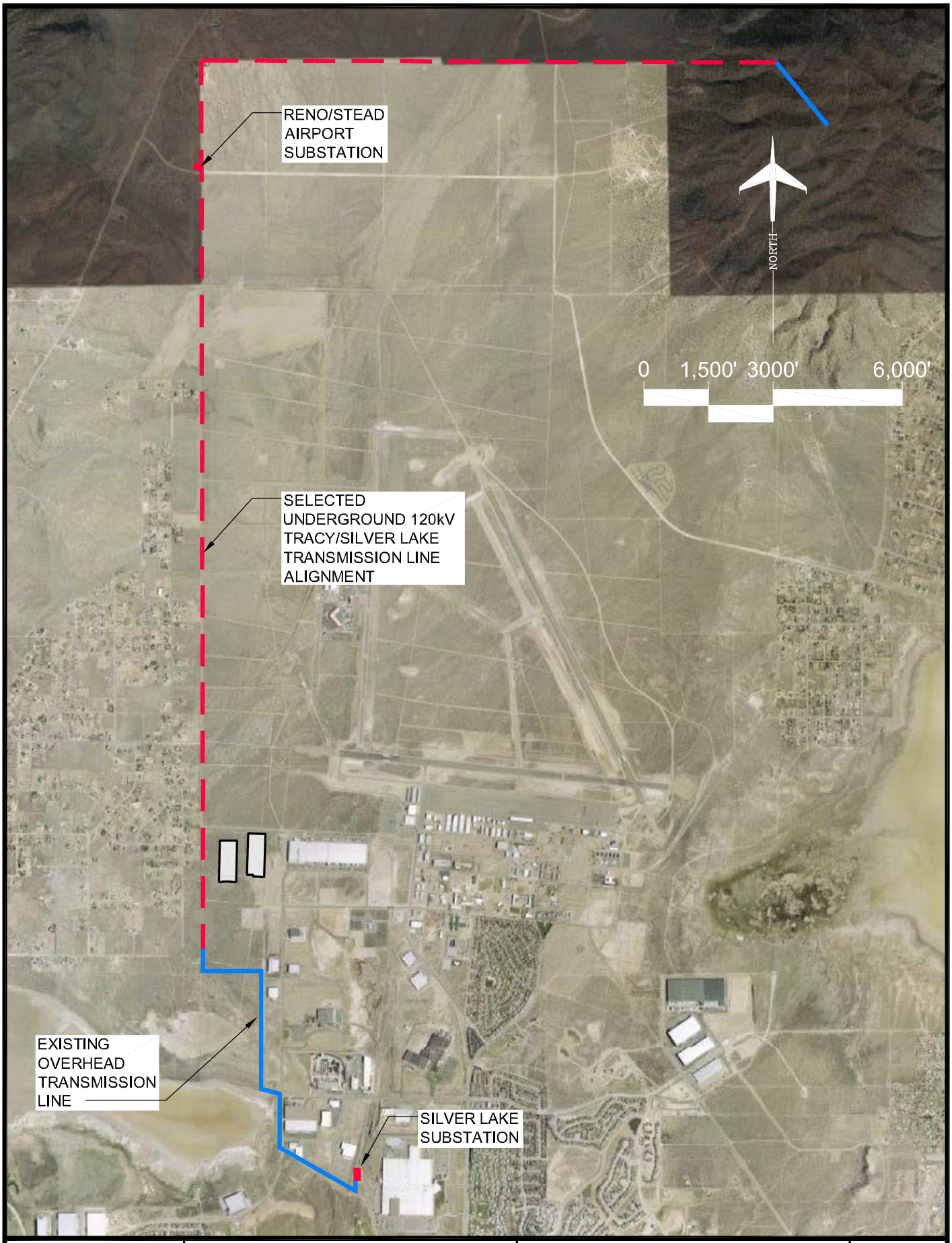
AT&T supplies the telephone service to RTS. The telephone lines generally run along similar alignments as the electric service to RTS. These lines run largely overhead with minimal underground service.

Figure 2-10 illustrates the existing utility networks.

2.11 LAND USE

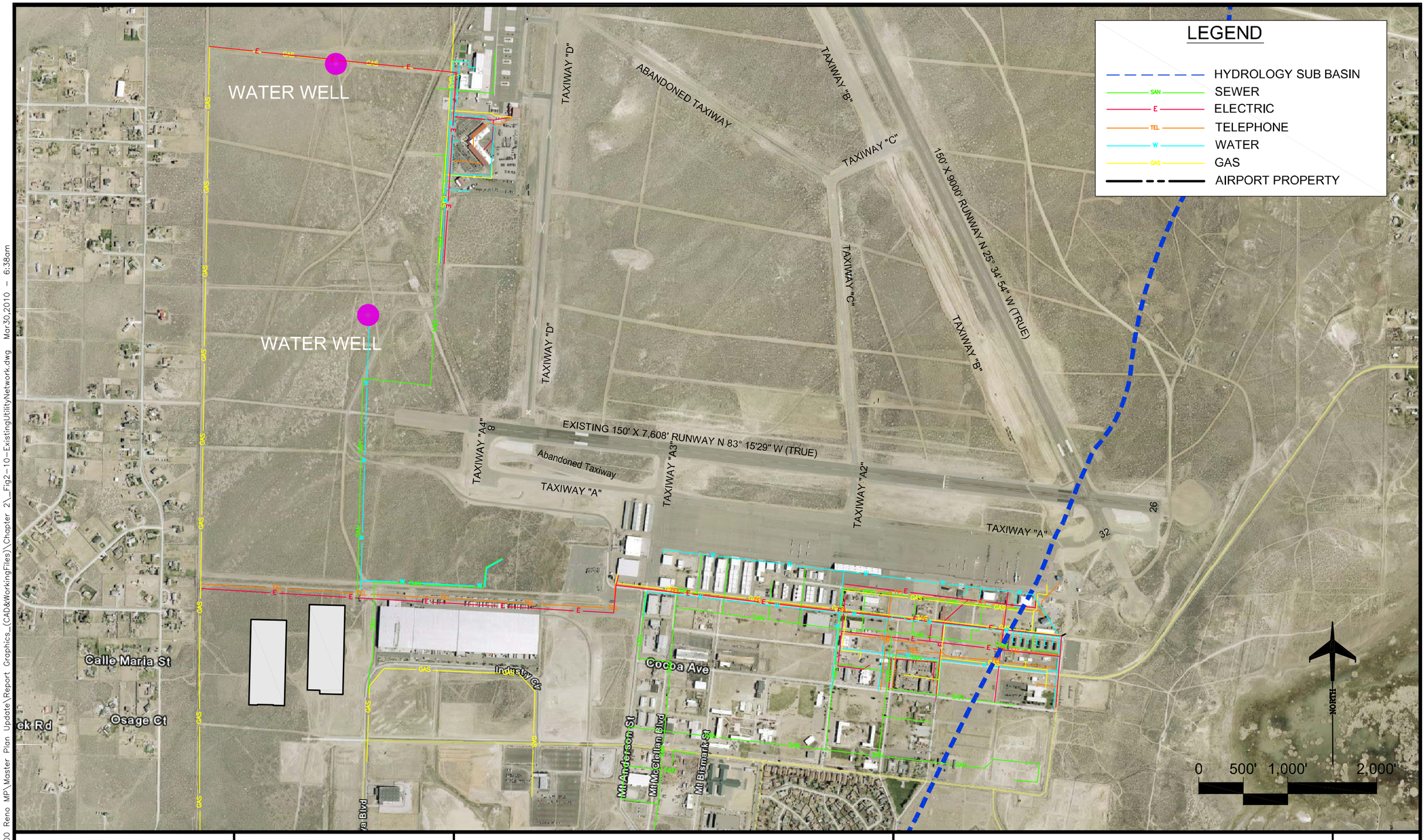
RTS is located in the northern section of an area known as the Stead Neighborhood, which is within the City of Reno's land use jurisdiction. Lands surrounding the Stead Neighborhood and RTS are under the jurisdiction of Washoe County. Areas east, west, and north of RTS include federal lands, open spaces, general rural, and low density suburban land uses. Industrial, residential, public, and open space land uses are located south of RTS.

RTS is located in the Reno-Stead Airport Regional Center Planning Area Overlay Zoning District (RSARC) as governed by the City of Reno. The purpose of the RSARC District, as identified in Title 18: Annexation and Land Development, is to "modify the underlying mixed use zoning land uses, developmental standards, and development review procedures within the Reno-Stead Airport Regional Center Planning Area Overlay District. This zoning district is intended to maintain the viability of regional airport operations and promote airport compatible uses on property owned by the Authority". **Table 2-4** presents a summary of the land use restrictions within the RSARC as outlined in Title 18: Annexation and Land Development.



PBS&J	Master Plan Update Reno-Stead Airport Reno, Nevada	Selected Tracy/Silver Lake Transmission Line Alignment	Figure 2-9

Plotted By: 11328
J:\AVServ\071889.00 Reno MP\Master Plan Update\Chapter 2 Graphics_Fig2-09-Prop_TSLake_Trans-Line.dwg Nov29,2007 - 11:38am



Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 2_Fig2-10-ExistingUtilityNetwork.dwg Mar30,2010 - 6:38am

PBS&J®

Reno-Tahoe Airport Authority
P.O. Box 12490
Reno, Nevada 89510
Phone: 775-328-6400
Fax: 775-328-6510

Master Plan Update
Reno-Stead Airport
Reno, Nevada

Existing Utility Network

Figure
2-10

Table 2-4. RSARC Zoning District

Permitted Uses	Prohibited Uses	Conditional Uses
All allowed, conditional and special use permit land uses in the Mixed Use (MU) zoning designation	Residential land uses	Stables and farms
All allowed, conditional and special use permit land uses in the Industrial Commercial (IC) zoning designation	Schools	
All allowed, conditional and special use permit land uses in the Industrial (I) district	Churches	
Lodging facilities (within one-half mile of the airport terminal)	Libraries	
ATC communication facilities	Medical facilities	
Temporary asphalt and concrete batch plants for airport construction (period not to exceed 4 years)	Daycare facilities	
Airport operations		
Airport facilities		

Source: Title 18: Annexation and Land Development, February 9, 2005.

Portions of RTs are also located within the Airport Critical Area Overlay District (ACA) and Airport Noise Exposure General Overlay District (ANE), which have further requirements on the use and development of land in the vicinity of RTS. The complete permitted uses and associated zoning restrictions for each of the three overlay districts can be found in the City of Reno's Title 18: Annexation and Land Development, Chapter 18.08, Zoning.

The existing land uses and their relation to RTS are illustrated in **Figure 2-11**. Solid colors represent lands that fall under the City of Reno jurisdiction, while hatched areas represent those lands that fall under the jurisdiction of Washoe County. Zoning in the vicinity of RTS is shown in **Figure 2-12.**

2.12 AIRSPACE STRUCTURE

RTS is located in Class E airspace and no active ATCT is in operation at RTS except during the National Championship Air Races and Air Show. Two-way communication through Reno approach/departure control is required before entering the local airspace surrounding RTS and a Common Traffic Advisory Frequency (CTAF) is used by pilots to announce their location and intentions when operating into and out of RTS. **Figure 2-13** depicts all the different types of airspace classes in use throughout the United States. The visual flight rules (VFR), and low altitude and high altitude airspace structure within the vicinity of RTS are illustrated in **Figures 2-14, 2-15, and 2-16**, respectively.

RENO LAND USE LEGEND

- AIRPORT CRITICAL AREA
- OPEN SPACE
- SINGLE FAMILY RESIDENTIAL
- INDUSTRIAL
- PUBLIC FACILITY
- AIRPORT PROPERTY
- MIXED USE
- GENERAL RURAL
- LOW DENSITY SUBURBAN
- MEDIUM DENSITY SUBURBAN

FEDERAL LANDS/ OPEN SPACE

FEDERAL LANDS/ OPEN SPACE

FEDERAL LANDS/ OPEN SPACE

FEDERAL LANDS/ OPEN SPACE

LOW DENSITY SUBURBAN

FEDERAL LANDS/ OPEN SPACE

FEDERAL LANDS/ OPEN SPACE

FEDERAL LANDS/ OPEN SPACE

FEDERAL LANDS/ OPEN SPACE

SCALE 1 : 11,693

1,000 0 1,000 2,000 3,000 FEET

NORTH

PBS&J

Reno-Tahoe Airport Authority
P.O. Box 12490
Reno, Nevada 89510
Phone: 775-328-6400
Fax: 775-328-6510

Master Plan Update
Reno-Stead Airport
Reno, Nevada

Existing Land Use

Figure 2-11

Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 2_Fig2-11-Land Use Plan.dwg Mar30,2010 - 6:43am

RENO ZONING LEGEND

LLR2.5 - Large Lot Residential (2.5 Acres)
SF15 - Single-Family Residential (15,000 sq. ft.)
SF6 - Single-Family Residential (6,000 sq. ft.)
SF4 - Single-Family Residential (4,000 sq. ft.)
MU - Mixed Use
OS - Open Space
PF - Public Facility
I - Industrial
IC - Industrial Commercial
IB - Industrial Business

AIRPORT PROPERTY
MIXED USE

FEDERAL LANDS/ OPEN SPACE
GENERAL RURAL
LOW DENSITY SUBURBAN
MEDIUM DENSITY SUBURBAN
MU
OS
PF
I
IB
IC
SF-15
SF-6
SF-4
LLR-2.5

SCALE 1 : 11,693
1,000 0 1,000 2,000 3,000 FEET

NORTH

Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 2_Fig2-12-Zoning.dwg Mar30,2010 - 6:44am

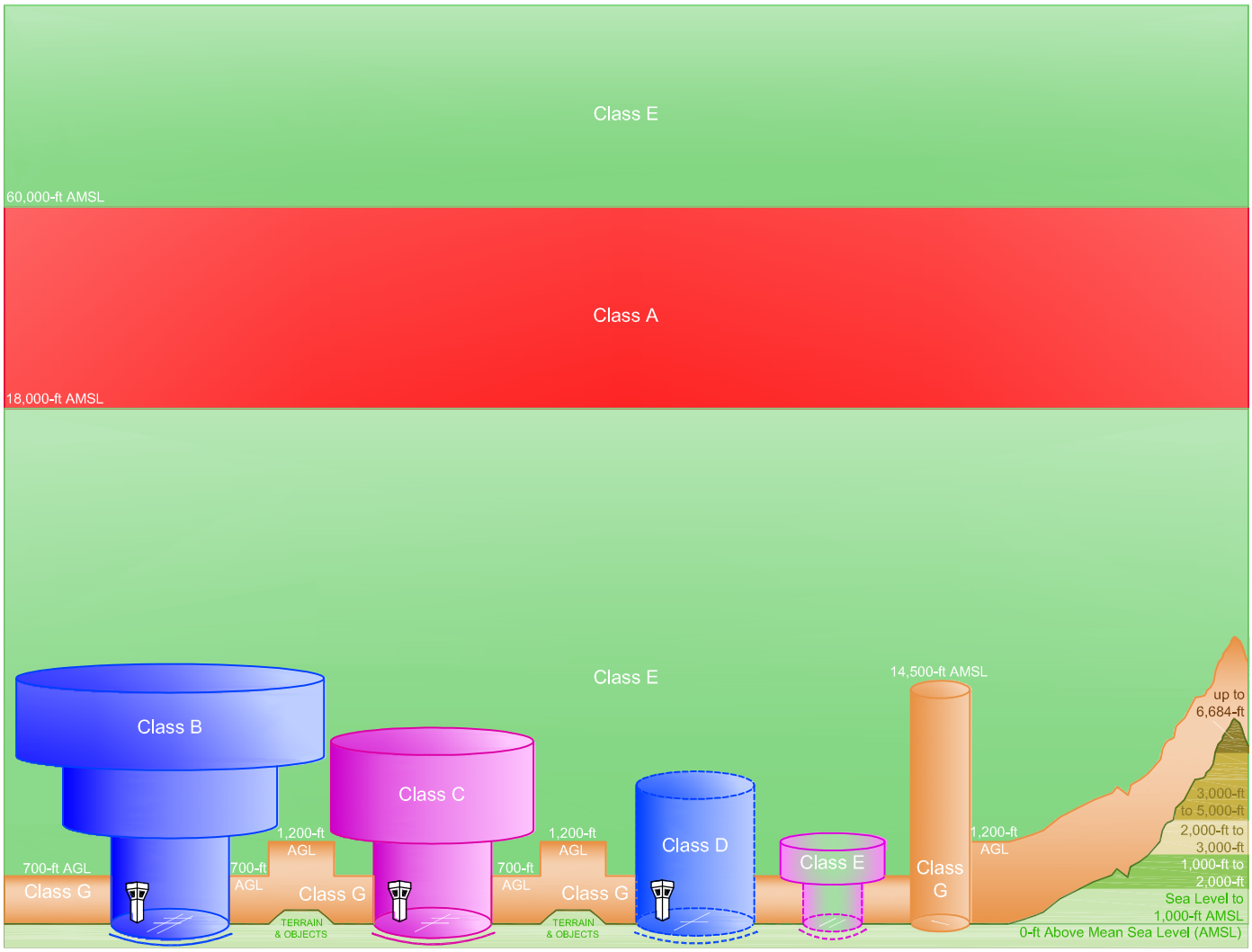
PBS&J®

Reno-Tahoe Airport Authority
P.O. Box 12490
Reno, Nevada 89510
Phone: 775-328-6400
Fax: 775-328-6510

Master Plan Update
Reno-Stead Airport
Reno, Nevada

Existing Zoning

Figure 2-12



Communication Requirements and Weather Minimums

	Class A	Class B	Class C	Class D	Class E	Class G
Minimum Pilot Qualification	Instrument Rating	Student *	Student *	Student *	Student *	Student *
Entry Requirements	IFR: ATC Clearance VFR: Operations Prohibited	ATC Clearance	IFR: ATC Clearance VFR: Two-Way Communication w/ ATC	IFR: ATC Clearance VFR: Two-Way Communication w/ ATC	IFR: ATC Clearance VFR: None	None
VFR Visibility Below 10,000 AMSL **	N/A	3 Statute Miles	3 Statute Miles	3 Statute Miles	3 Statute Miles	Day: 1 Statute Mile Night: 3 Statute Miles
VFR Cloud Clearance Below 10,000 AMSL	N/A	Clear of Clouds	500 Below 1,000 Above 2,000 Horizontal	500 Below 1,000 Above 2,000 Horizontal	500 Below 1,000 Above 2,000 Horizontal	500 Below 1,000 Above 2,000 Horizontal ***
VFR Visibility 10,000 AMSL and Above **	N/A	3 Statute Miles	3 Statute Miles	3 Statute Miles	5 Statute Miles	5 Statute Miles
VFR Cloud Clearance 10,000 AMSL and Above	N/A	Clear of Clouds	500 Below 1,000 Above 2,000 Horizontal	500 Below 1,000 Above 2,000 Horizontal	500 Below 1,000 Above 1 Statute Mile Horizontal	1,000 Below 1,000 Above 1 Statute Mile Horizontal
Airport Application	N/A	• Radar • Instrument Approaches • Weather • Control Tower • High Density	• Radar • Instrument Approaches • Weather • Control Tower	• Instrument Approaches • Weather • Control Tower	• Instrument Approaches • Weather	
Special VFR Permitted?	No	Yes	Yes	Yes	Yes	N/A

* Prior to operating within Class B, C, or D airspace (or Class E airspace with an operating control tower), student, sport, and recreational pilots must meet the applicable FAR Part 61 training and endorsement requirements. Solo student, sport, and recreational pilot operations are prohibited at those airports listed in FAR Part 91, Appendix D, Section 4.

** Student pilot operations require at least 3 statute miles visibility during the day and 5 statute miles visibility at night.

*** Class G VFR cloud clearance at 1,200 AGL and below (day): clear of clouds.

PBS&J

Master Plan Update
Reno-Stead Airport
Reno, Nevada

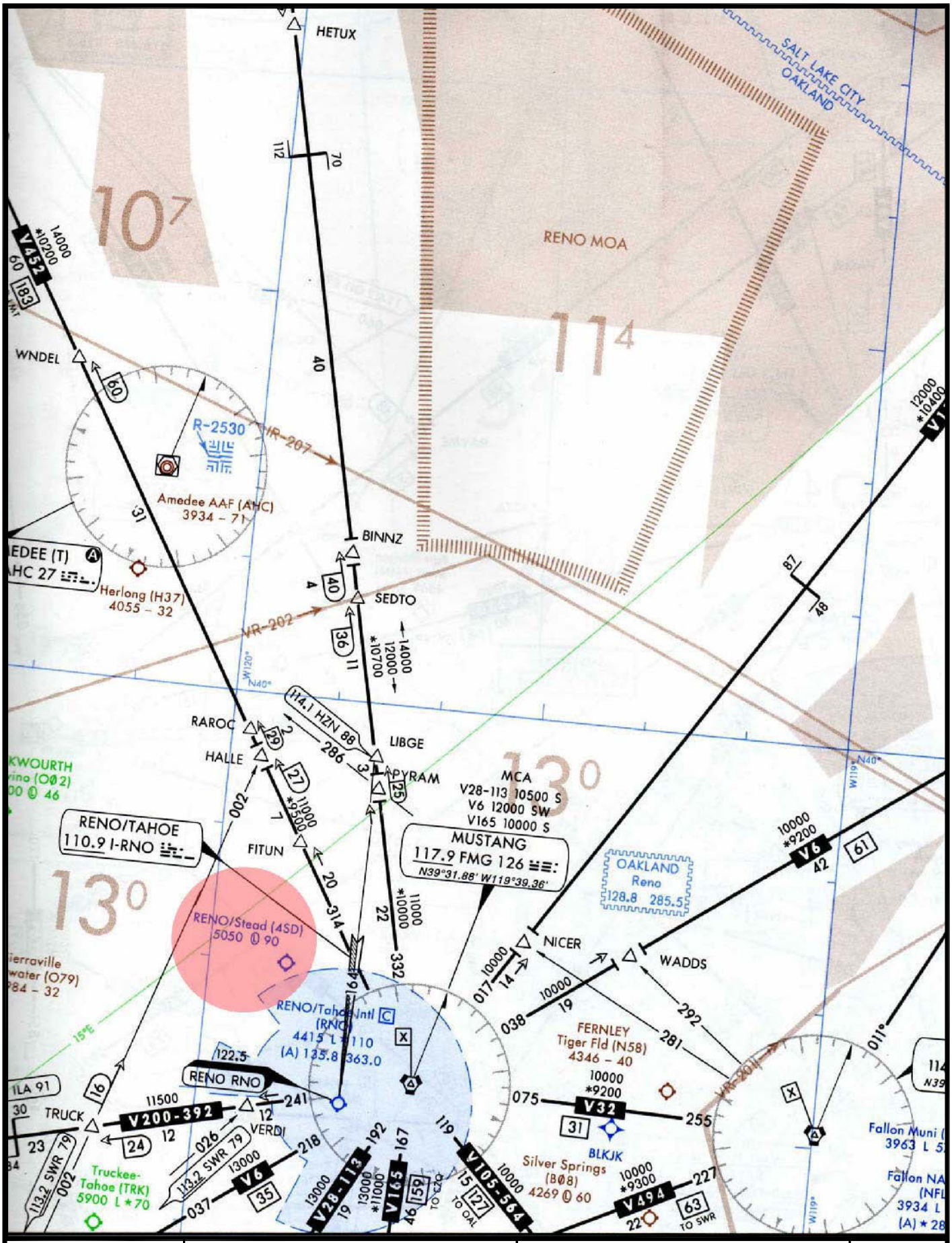
Airspace Classifications

Figure 2-13

Plotted By: 22633
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 2_Fig2-13-AirspaceClassification.dwg Dec16,2009 - 3:28pm

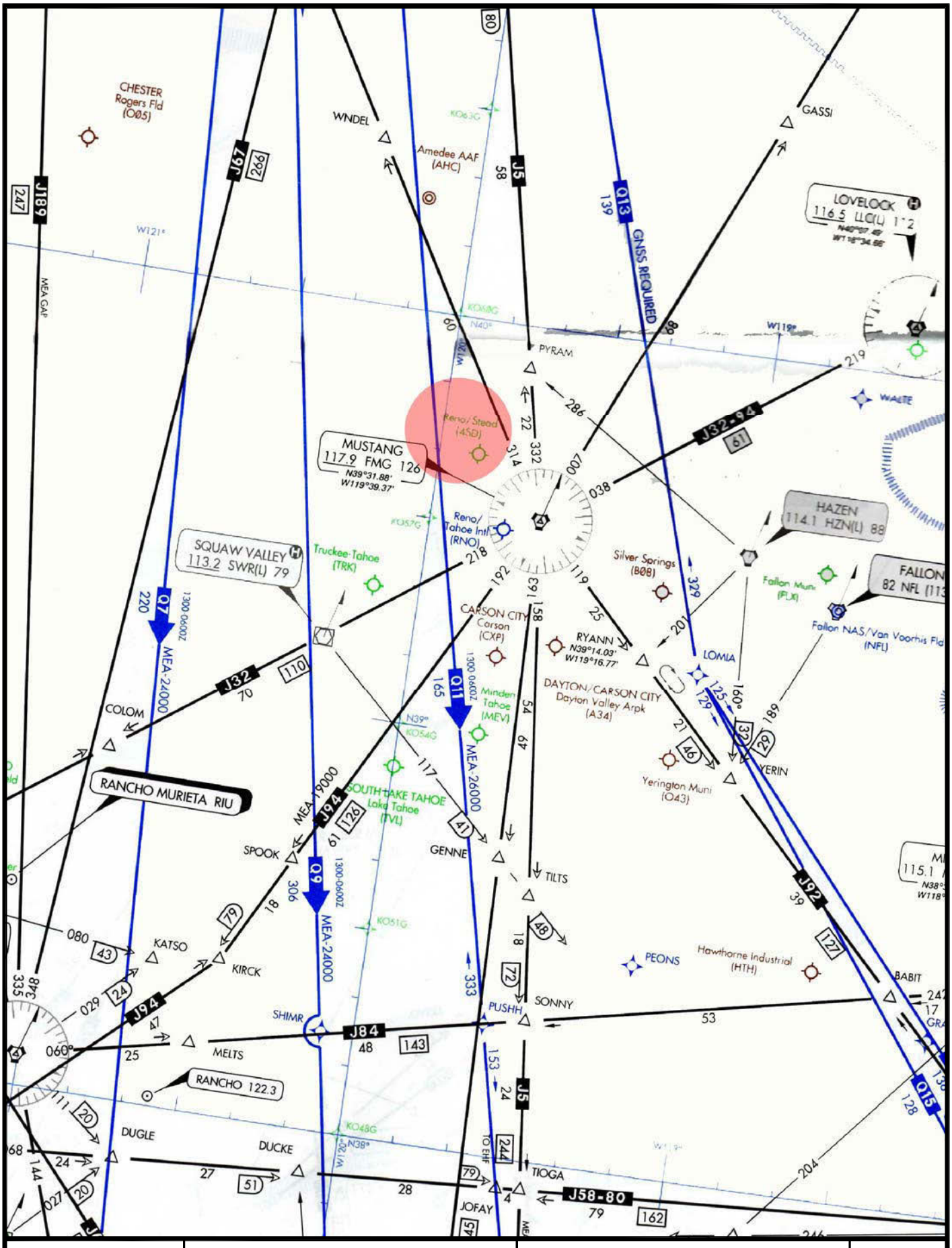
Plotted By: 11328
J:\AVServ\071889.00 Reno MP\Master Plan Update\Chapter 2 Graphics_Fig2-14-VFR-Airspace.dwg Nov29,2007 - 1:33pm

PBS&J	Master Plan Update Reno-Stead Airport Reno, Nevada	VFR Airspace Structure	Figure 2-14



PBS&J	Master Plan Update Reno-Stead Airport Reno, Nevada	Low Altitude Airspace Structure	Figure 2-15

Plotted By: 11328
J:\AVServ\071889.00 Reno MP\Master Plan Update\Chapter 2 Graphics_Fig2-15_Low Altitude.dwg Nov29,2007 – 1:34pm



PBS&J	Master Plan Update Reno-Stead Airport Reno, Nevada	High Altitude Airspace Structure	Figure 2-16

Plotted By: 11328
J:\AVServ\071889.00 Reno MP\Master Plan Update\Chapter 2 Graphics_Fig2-16-HighAltitude.dwg Nov29,2007 - 1:36pm

2.12.1 Instrument Approach Procedures

The existing instrument approaches to RTS include a precision instrument landing system (ILS) approach to Runway 32, a non-precision global positioning system/area navigation (GPS/RNAV) approach to Runway 32 and GPS circling approaches to Runways 14 and 32. The lowest approach minimums possible utilizing these approaches is an altitude of 6,390 feet mean sea level (1,400 feet above ground level) and visibility of two miles. The existing published instrument approaches can be found in **Figures 2-17, 2-18,** and **2-19**.

2.12.2 Part 77 Obstructions to Navigable Airspace

Federal Aviation Regulations (FAR) Part 77, *Obstructions to Navigable Airspace*, establish standards for determining obstructions to specific airspace surfaces on and in the vicinity of an airport. An obstruction is defined as any object of natural growth, terrain, or permanent or temporary construction and/or alteration, including related equipment and materials used therein, which penetrate any portion of the "imaginary surfaces." FAR Part 77 establishes these imaginary surfaces to govern the vertical height of obstacles within the vicinity of airports. These surfaces will vary in size and slope depending on the type of runway and the available approaches to each runway end.

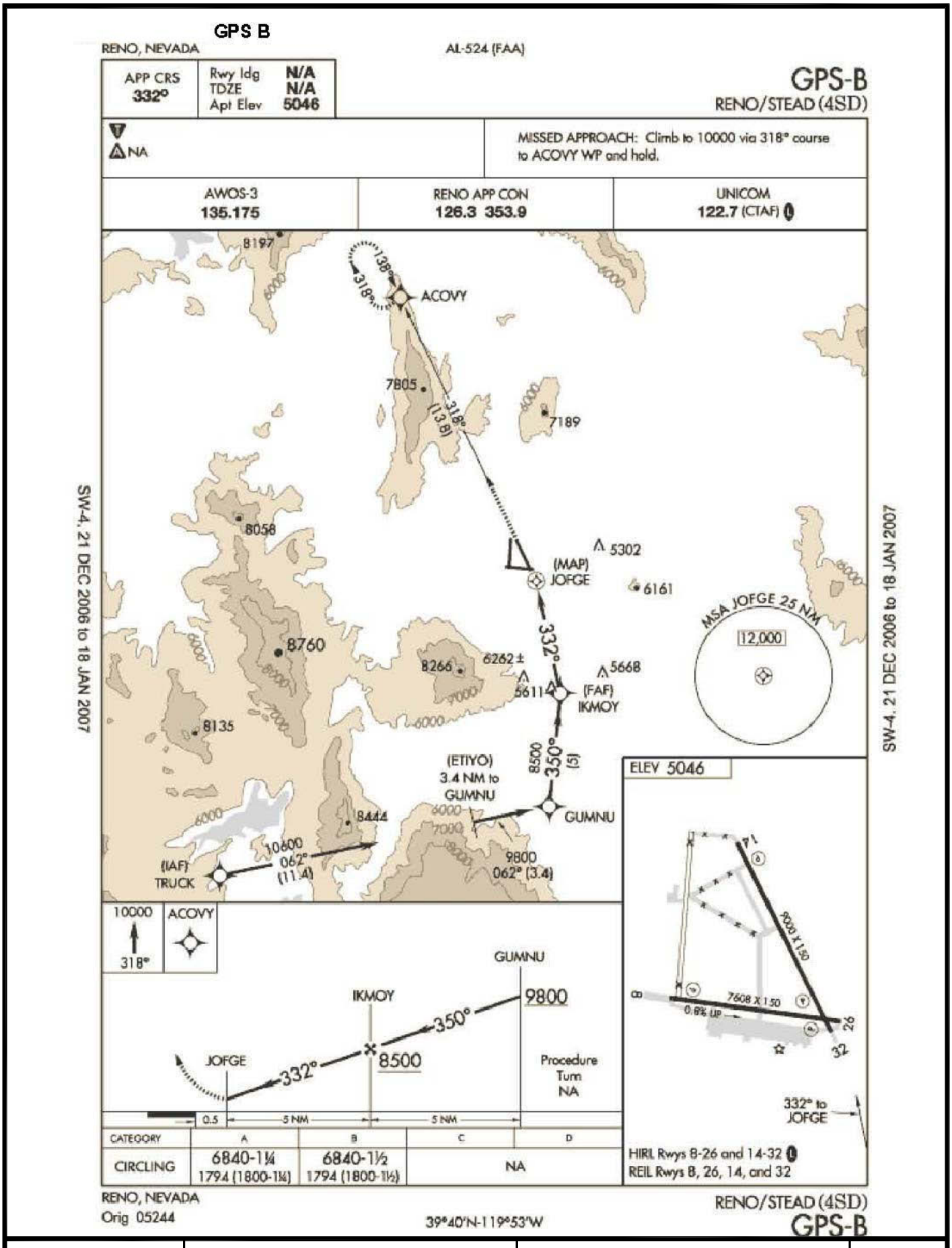
By superimposing these imaginary surfaces over an airport, it is possible to determine the existence and/or severity of obstructions. FAR Part 77 surfaces also provide vertical boundaries for new construction and alterations to existing structures. Once obstructions have been identified, the FAA must review them to determine if they pose a hazard to air navigation. If determined to be a hazard, the obstruction must be removed or altered to eliminate the penetration. If the obstruction is not removed, changes to the airfield and/or approach procedures may be required. Examples of such changes could be displacing a runway threshold or increasing approach minimums to provide obstruction clearance. Any existing obstructions to air navigation at RTS will be discussed in Chapter 7 Airport Layout Plans chapter and further identified on the Airspace drawing within the ALP set. **Figure 2-20** illustrates typical FAR Part 77 surfaces for a precision approach runway.

2.12.3 Special-Use Airspace

Special-use airspace is used to confine certain flight activities and to place limitations on aircraft operations that are not part of these activities. Special-use airspace is divided into alert areas, Military Operation Areas (MOA), warning areas, restricted areas, prohibited areas, controlled firing areas, and national security areas. Although the Nevada Army National Guard is located at RTS, there are no special-use designations within 25 nautical miles of RTS. The nearest special-use airspace designation is the Reno MOA, located approximately 35 nautical miles to the north-northeast of RTS.

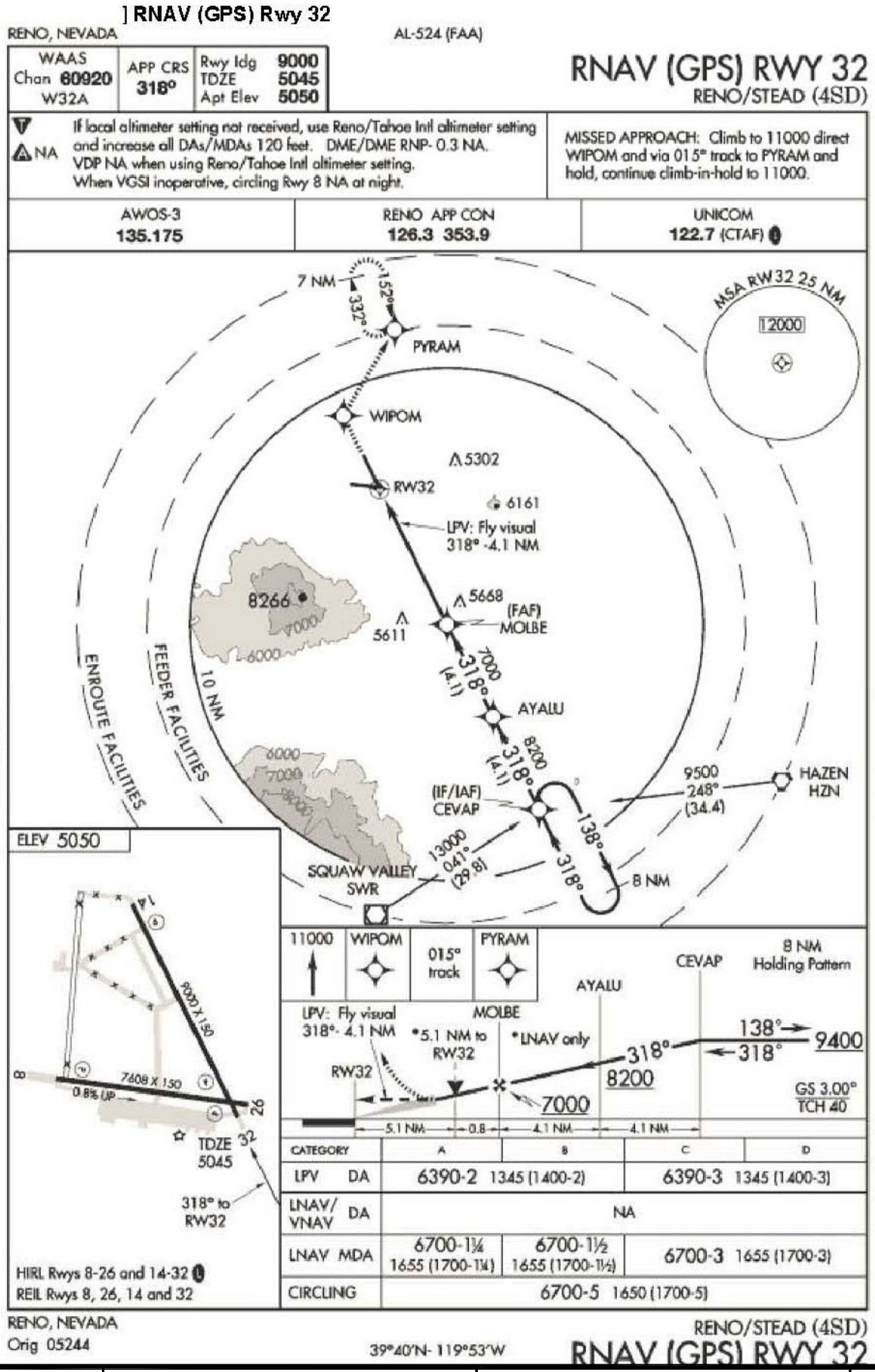
2.13 AIRPORTS IN THE VICINITY

Airports located in the surrounding region are of considerable importance when evaluating sources of competition for airspace and aviation services. RTS has many neighboring airports, including public, private, and commercial facilities. Eighteen airports within a 50-nautical-mile radius of RTS have been identified and are discussed briefly in this section. The locations of all airports in the vicinity of RTS are illustrated in **Figure 2-21**.



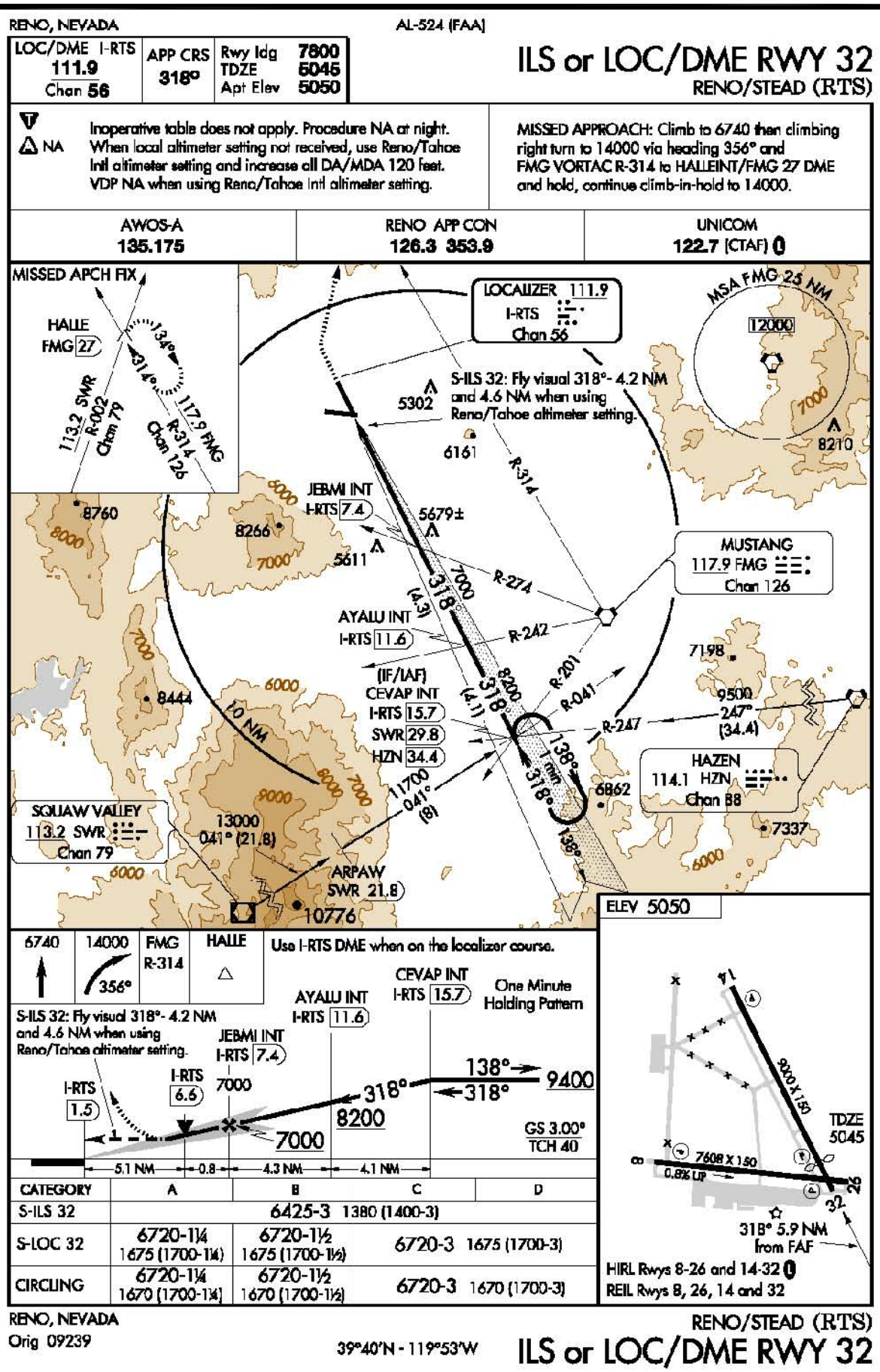
PBS&J	Master Plan Update Reno-Stead Airport Reno, Nevada	Instrument Approach Procedures Circling GPS	Figure 2-17

Plotted By: 11328
J:\AVServ\071889.00 Reno MP\Master Plan Update\Chapter 2 Graphics_Fig2-17-GPS-RWY32.dwg Nov29,2007 - 1:37pm



Plotted By: 11328
J:\AVServ\071889.00 Reno MP\Master Plan Update\Chapter 2 Graphics_Fig2-18-VOR-DME.dwg Nov29,2007 - 1:38pm

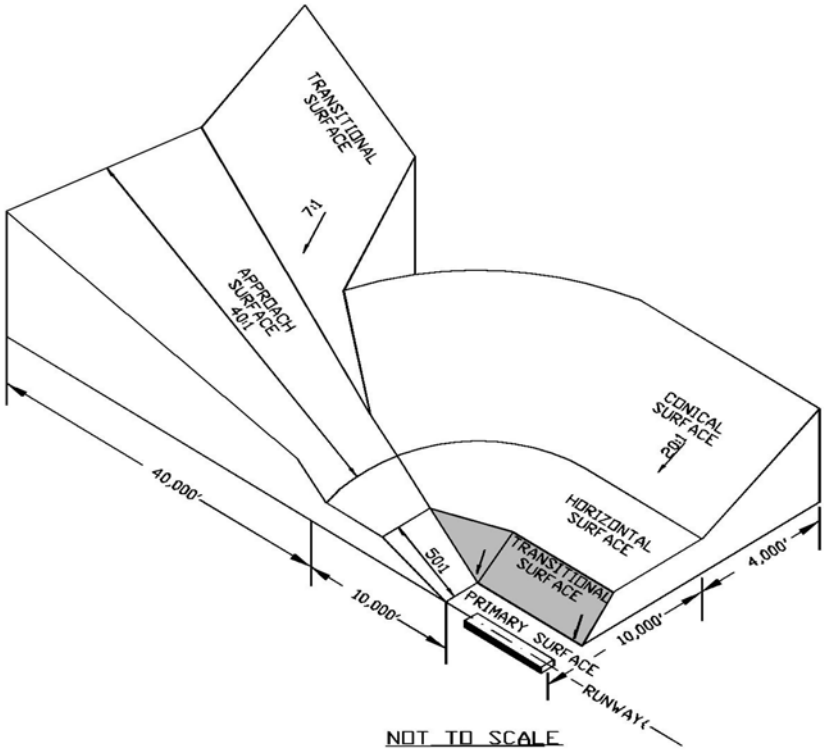
PBS&J	Master Plan Update Reno-Stead Airport Reno, Nevada	Instrument Approach Procedures RNAV / GPS Runway 32	Figure 2-18



Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 2\Fig2-19-ILS.dwg Dec03,2009 - 7:15am

PBS&J	Master Plan Update Reno-Stead Airport Reno, Nevada	Instrument Approach Procedures ILS or LOC/DME Rwy 32	Figure 2-19

Figure 2-20. Typical Precision Approach Part 77 Surfaces



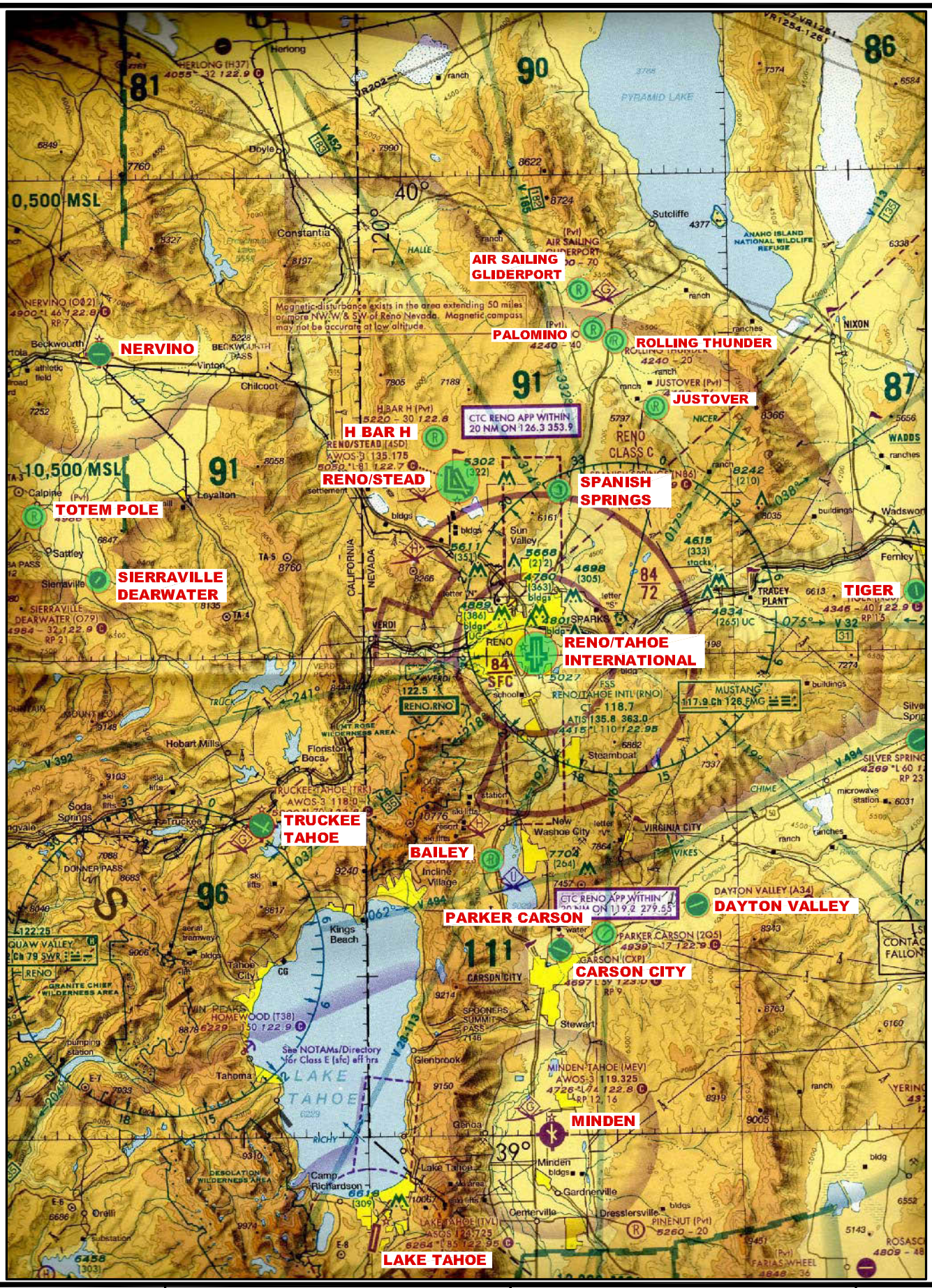
2.13.1 Private-Use

There are seven private-use airports in the area; these airports do not have services available to the general public. **Table 2-5** displays the private-use GA airports, their runway lengths, and their distances from RTS.

Table 2-5. Private Use GA Airports in the Region

Airport Name	Runway length	Distance from RTS
Totem Pole	1,800 feet	25 nm southwest
Air Sailing Gliderport	7,000 feet	17 nm northeast
Rolling Thunder	2,000 feet	14 nm northeast
Bailey Ranch	2,600 feet	22 nm south
H Bar H	3,000 feet	5 nm north
Justover Field	2,600 feet	12 nm northeast
Palomino	4,000 feet	13 nm southwest

Source: San Francisco Sectional Aeronautical Chart 2006.
nm = nautical miles



PBS&J	Master Plan Update Reno-Stead Airport Reno, Nevada	Airports in the Vicinity	Figure 2-21

Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 2_Fig2-20-VicinityAirports.dwg Dec03,2009 - 7:17am

2.13.2 Public-Use

Several public-use airports lie within a 50-nautical-mile radius of RTS. These airports include: Reno-Tahoe International Airport (RNO), Truckee Tahoe Airport (TRK), Nervino Airport (O02), Sierraville Dearwater Airport (O79), Spanish Springs Airport (N86), Carson City Airport (CXP), Parker Carson STOLport (2Q5), Dayton Valley Airport (A34), Tiger Field (N58), Minden Tahoe Airport (MEV) and Lake Tahoe Airport (TVL). Information about these facilities is discussed briefly in the following sections.

2.13.2.1 Reno-Tahoe International Airport

RNO is a primary commercial service airport located 11 miles southeast of RTS, which is also owned by RTAA. RNO has three runways, 16R-34L which is 11,002 by 150 feet, 16L-34R which is 9,000 by 150 feet and Runway 7-25 which is 6,102 by 150 feet. RNO provides a complete array of GA services through three Fixed Base Operators (Jet West, Atlantic Aviation and Sierra Air Center) and is the primary air carrier airport for residents in several northern Nevada and California counties.

2.13.2.2 Truckee-Tahoe Airport

TRK is a publicly owned, public-use GA airport located 24 nautical miles southwest of RTS. TRK has two runways. Runway 1-19 is 4,650 by 75 feet and Runway 10-28, which is the primary runway, is 7,000 by 100 feet.

A variety of services and accommodations are available at TRK, including fuel, aircraft parking, aircraft rentals, maintenance, car rentals, a pilot lounge, and restrooms. Annual operations at TRK were reported to be 35,000 in 2005 and there were 123 based aircraft.

2.13.2.3 Nervino Airport

O02 is a public-use, publicly owned GA airport located 24 nautical miles west-northwest of RTS. O02 has one asphalt runway, Runway 7-25, which is 4,651 by 75 feet. O02 has approximately 28 based aircraft on the field. The total operations at O02 were reported to be approximately 16,000 in 2005.

2.13.2.4 Sierraville-Dearwater Airport

O79 is a public-use, publicly owned GA airport located approximately 22 nautical miles west-southwest of RTS. The asphalt runway at O79 is 3,260 by 50 feet. O79 is operated by Sierra County, California. Services are limited at O79, as there is no FBO on the property. Fuel is not available and aircraft storage is only available as a tie-down service. There is one single-engine based-aircraft reported at this field.

2.13.2.5 Spanish Springs Airport

N86 is a public-use, publicly owned GA airport located approximately seven nautical miles east of RTS. N86 has a 3,540 by 71-foot dirt runway. There are 13 reported single-engine based aircraft at the field. Aviation services and other accommodations at N86 are provided by the FBO and include fuel, oxygen, aircraft parking, flight training, transportation, restrooms, and a camping site.

2.13.2.6 Carson City Airport

CXP is a publicly owned, public-use airport located approximately 28 nautical miles south-southeast of RTS. CXP has one asphalt runway. Runway 9-27 is 5,906 by 75 feet. There are two FBOs on the property: El Aero Services and Eagle Valley Fuel. Based aircraft at the facility are reported to be about 275.

2.13.2.7 Parker Carson STOLport

2Q5 is a privately owned public-use STOLport with one runway, located approximately 29 nautical miles south-southeast of RTS. A STOLport is defined as an airport designed for aircraft that only need a short runway. 2Q5's one gravel runway, 6-24, is 1,700 by 40 feet. There are no FBO services located on the field. There are five reported based aircraft on the field.

2.13.2.8 Dayton Valley Airpark

A34 is a privately owned public-use airport located approximately 30 nautical miles south-southeast of RTS. The airport has one 5,343 by 75-foot runway. There are no FBO services or aircraft storage facilities on the airport. The airport is unattended and has a windsock and a segmented circle. There are reportedly 14 single-engine aircraft based at the airport.

2.13.2.9 Tiger Field

N58 is a publicly owned public-use airport. N58 is located approximately 30 nautical miles east of RTS. The airport is unattended and has no services or facilities, other than tie-down aircraft storage. N58 has two runways. Runway 5-23 is 2,750 by 40 feet while Runway 15-33 is 3,974 by 40 feet. There are six reported single-engine aircraft based at the airport.

2.13.2.10 Minden-Tahoe Airport

MEV is a publicly owned public-use airport. MEV is located 40 nautical miles south of RTS. The facility has two paved runways. Runway 16-34 is 7,400 feet long and 100 feet wide and Runway 12-30 is 5,300 feet long and 75 feet wide. MEV also has a one unpaved runway, Runway 12G-30G, that is 2,200 feet long and 60 feet wide. MEV is attended from 8 AM to 4 PM. Soar Minden is the FBO at MEV; they offer a wide variety of services including fuel, oxygen, flight training, parking and aircraft rental. There are 312 based aircraft and an average of 80,000 annual operations reported for MEV. Additionally, MEV has an extensive amount of glider activity.

2.13.2.11 Lake-Tahoe Airport

TVL is a publicly owned public-use airport with one runway. Runway 18-36 is a grooved asphalt runway 8,544 feet long and 150 feet wide. The airport is attended from 6:30 AM to 8:00 PM. There are 69 based aircraft and an average of 24,000 flights annually reported for TVL. Atlantic Aviation provides FBO services for TVL, which include a full service aircraft fuel facility. The airport also has a restaurant on property, the Chase Bar and Grill.

2.14 AREA-WIDE PLANS

The presence and operation of any airport has an effect on every other airport in the National Airspace System (NAS) and the nation's multi-modal transportation network in general. Therefore, regional, state, and national plans are developed in an effort to create a common goal and vision for the transportation system. The plans that must be considered in developing the Master Plan are the Nevada Airport System Plan Update, the Regional Transportation Commission of Washoe County – 2030 Regional Transportation Plan, the North Valley Area Plan, Truckee Meadows Regional Plan, Washoe County Comprehensive Plan, City of Reno Master Plan, Washoe County Consensus Forecasts, and the National Plan of Integrated Airports Systems (NPIAS).

2.14.1 2030 Regional Transportation Plan

The Regional Transportation Commission of Washoe County – 2030 Regional Transportation Plan focuses on development of the roadway system and is necessary to provide a vision for satisfying the existing and anticipated demands on the ground transportation system serving the Washoe County area. The goal of the plan is to provide a safe, efficient, and financially feasible transportation system, providing mobility for residents and economic vitality for the communities. The plan also ensures the respect of the natural and built environment and consistency with land use policies, while addressing multi-modal transportation issues. Consideration of this plan is especially important when discussing ground access, potential multi-modal networks, and land use surrounding RTS.

2.14.2 Nevada Airport System Plan

The Nevada Airport System Plan was updated in September 2004 for the Nevada Department of Transportation (NDOT). The Nevada Airport System Plan is a continuing planning process supported by multiple databases that provide current data on Nevada's aviation activity. The plan incorporates such topics as intermodal transportation networking, economic impact of airports on the local community and the State of Nevada, and development of long-range visions and strategies through strategic planning. The Nevada Airport System Plan provides background on the current anticipated role of RTS within the statewide airport system.

2.14.3 North Valley Area Plan

The most recent North Valley Area Plan was updated in 2004. The plan represents a commitment to a comprehensive and long-range inter-jurisdictional planning document that represents the vision and foresight of the people who live and work in the North Valley area and directly addresses development around RTS. The document is prepared by Washoe County and is intended to meet the needs of the County as well as shared needs of the City of Reno. The area plan provides guidance in analyzing and acting on all private and public development and is the foundation upon which development and land use regulations are based. The plan encompasses the zoning and subdivision ordinances, other development related codes or guidelines, and the County's capital improvement program. Since RTS is primarily within the City of Reno's jurisdiction, these standards only apply to the properties surrounding RTS and the RTAA owned properties to the east.

2.14.4 Truckee Meadows Regional Plan

The Truckee Meadows Regional Plan was last updated in 2007. The administration of the Truckee Meadows Regional Plan is conducted by the Truckee Meadows Regional Planning Agency (TMRPA). The plan provides an opportunity to put into place a resource for the region with a collaborative structure that will serve Truckee Meadows. The regional plan is structured around four planning principles:

- Provide direction and standards for how and where development occurs in Truckee Meadows
- Address the management of natural resources
- Coordination of public facilities and services
- Implement framework for the plan

2.14.5 Washoe County Comprehensive Plan

The Washoe County Comprehensive Plan is the official master plan for the portions of Washoe County outside the Spheres of Influence for the cities of Reno and Sparks and includes countywide elements, area plans, and a number of other more detailed plans. The comprehensive plan was developed in May of 1994 and is currently undergoing various plan and/or element updates. The purpose of the Comprehensive Plan is to act as a guide for the Washoe County Board of County Commissioners, the Washoe County Planning Commission, and the community on matters of growth and development. The Comprehensive Plan guides growth by establishing and implementing policies and action programs which address countywide issues and concerns. The Comprehensive Plan also contains area plans which recognize critical conservation areas, establish existing and future land use and transportation patterns, and identify current and future public services and facilities needs for the County's planning areas.

2.14.6 City of Reno Master Plan

The City of Reno Master Plan includes citywide plans that cover the City and sphere of influence, plans for centers and transit oriented development (TOD) corridors, and neighborhood plans. An update of The City of Reno Master Plan was completed in October 2007. The plan is divided into four sections: *Introduction, Citywide Plans, Center and Corridor Plans, and Neighborhood Plans*.

- The Introduction addresses and summarizes the three main areas within the master plan.
- The Citywide Plan covers the City and its Sphere of Influence.
- The Center and Corridor Plans cover the regional centers and transit oriented development corridors identified in the citywide Land Use Plan and the Truckee Meadows Regional Plan.
- The Neighborhood Plans cover specific areas of the City, other than centers and corridors, where the City Council and Planning Commission have determined that a more detailed plan is necessary.

2.14.7 Washoe County Consensus Forecasts

The *Washoe County Consensus Forecast 2008-2030* provides projections of population, employment, and income for Washoe County. The *Washoe County Consensus Forecast 2008-2030* minimizes the risk of large forecast errors by using a number of sources including:

- Global Insight - a national forecasting firm in Massachusetts that prepares national, state and county forecasts.
- NPA Data Services, Inc. - a national forecasting firm in Arlington, Virginia that forecasts for every county in the United States as well as state and national forecasts.
- Truckee Meadows Water Authority's Population and Employment Econometric Model.
- Woods and Poole - a national forecasting firm in Washington, DC that forecasts for every county in the United States, as well as state and national forecasts.
- 2006 State Demographer's Forecast.

2.14.8 National Plan of Integrated Airports System

The 2007-2011 NPIAS was submitted to Congress in accordance with Section 47103 of Title 49 of the United States Code. The plan identifies 3,431 existing airports that are significant to national air transportation and contains estimates that $46.2 billion in infrastructure development, eligible for federal aid, will be needed over the next five years to meet the needs of all segments of civil aviation. A primary purpose of the NPIAS is to determine eligibility of the significant airports, which consists of all commercial service airports, all reliever airports, and selected GA airports, to receive grants under the Airport Improvement Program (AIP).

The NPIAS classifies RTS as a reliever airport. Reliever airports provide pilots attractive alternatives to using congested hub airports. They also provide GA access to the surrounding area. According to the FAA, there are 274 reliever airports in the NPIAS eligible for approximately $2.89 billion for development projects from 2007 to 2011. Reliever airports also receive special attention in AIP funding.

Reliever airports included in the plan have an average of 232 based aircraft and account for approximately 29 percent of the nation's GA fleet. Understanding the role of reliever airports within the NPIAS is important to understanding the potential future demand and needs of RTS.

2.15 AIRPORT SURVEYS AND TENANT INTERVIEWS

Participation by users of RTS is an essential step in the master planning process and can provide critical information to the planning process. Two questionnaires/surveys were distributed to the airport users, specifically based aircraft tenants and transient pilots. Additionally, interviews were conducted with the larger commercial tenants to obtain more detailed information on-airport facilities, tenant operations, existing demand, and future development plans and/or needs.

The primary goals of the questionnaires and interviews were to collect additional facility and operational data and assist in the identification of future facility requirements. A total of 59 completed tenant and pilot/passenger surveys were received and seven interviews with commercial tenants were conducted. The responses of these surveys and interviews were consolidated and are presented in **Table 2-6.** Copies of the surveys used in this process are presented in **Appendix B**.

Through the use of both the surveys and interviews it was determined that the majority of existing based users are comfortable with the overall existing airport facilities. However, based on the responses, there is a moderate need for a larger terminal facility and a significant need for additional hangars to meet existing demand. Further, a need for a consolidated flight training facility and small food service facility (e.g., restaurant or café) was also identified during tenant interviews and stated within the Other Services section of the surveys. Fuel services and vehicular access to RTS were generally identified as adequate. Some demand for additional maintenance services was identified.

The results of the surveys and interviews will be considered when developing the forecasts of aviation demand and completing demand/capacity and facility requirements analyses later in Chapters 3 and 4.

Table 2-6. Consolidated Results of Airport Surveys and Tenant Interviews

	Single	Twin	Turbo Prop	Jet	Helicopter
Respondents total based aircraft	80	4	2	1	21
Respondents monthly operations (est.)	788	20	40	10	76

Airport Planning Questionnaire Questions	Responses	
	Yes	No
Sufficient Apron Space	55	2
Sufficient Hangar Space	29	25
Sufficient Terminal Facilities	43	21
Sufficient Vehicle Parking	53	7
Sufficient Vehicle Access	56	7
Sufficient Fueling Services	52	10
Sufficient Aircraft Maintenance Services	40	16
Would you store your tied-down aircraft in hangar space if available	19	2

Source: PBS&J, 2007.

FORECAST OF AVIATION DEMAND

Reno-Stead Airport

3

3.1 GENERAL OVERVIEW

This chapter presents forecasts of aviation activity for Reno-Stead Airport (RTS) that will serve as the basis for airport facility planning over a 20-year planning period and beyond (2006 to 2030). Although these forecasts cover an extended timeframe, aviation, social, and economic trends can only be projected with reasonable confidence for the near-term (3-7 years). Unexpected events in any of these trends can cause dramatic changes to the 20-year projections. Therefore, aviation activity forecasts and master plans themselves must continually be evaluated and updated on a regular basis.

The forecast analysis identifies the Air Trade Area, describes socioeconomic characteristics, discusses the methodology used for projecting aircraft activity at RTS, and examines historical data, recent aviation trends, as well as local factors to provide updated General Aviation (GA) forecasts for the following:

- Based aircraft and fleet mix
- Airport operations (local and itinerant)
- Instrument approach operations
- Peak hour airport operations
- Fuel flowage

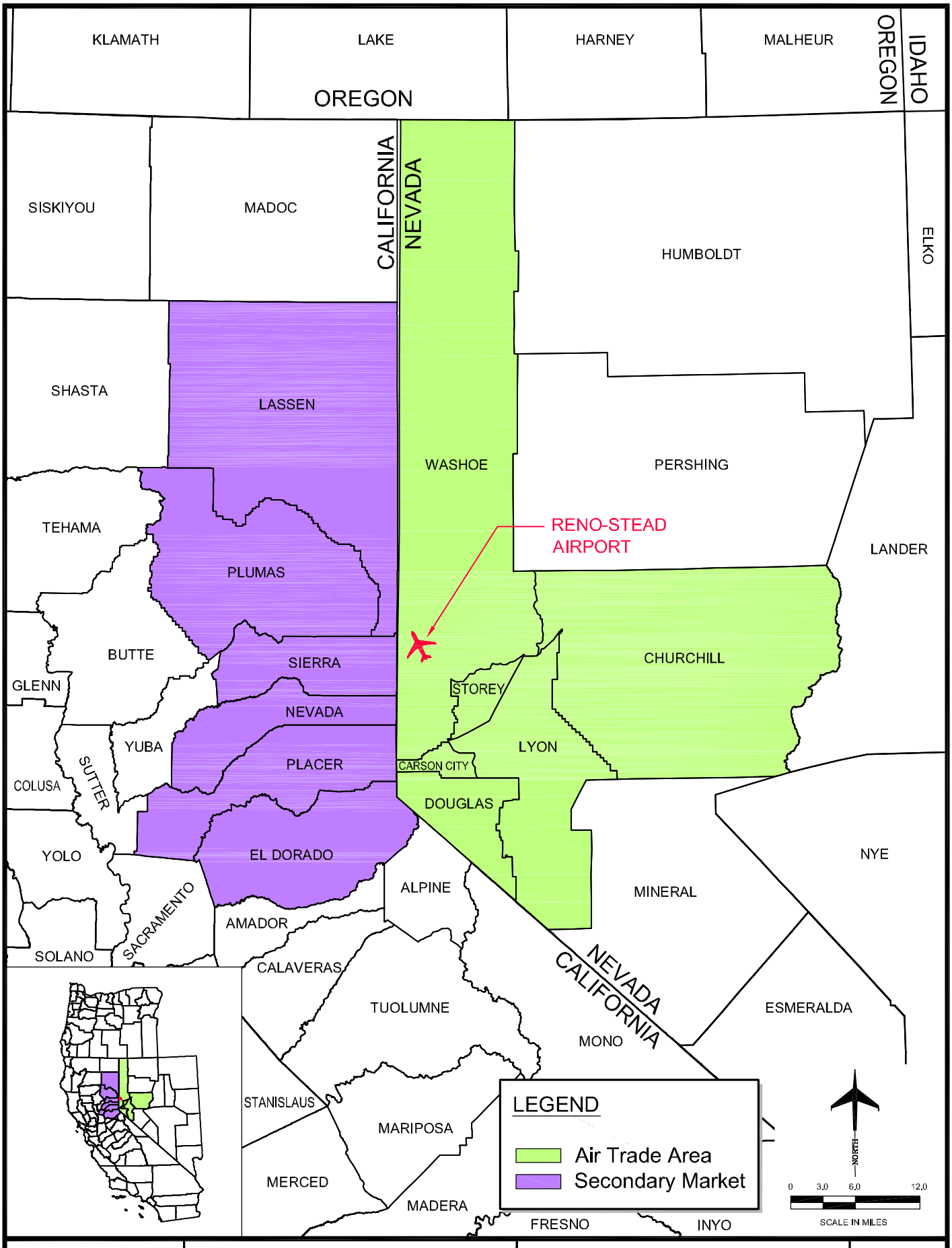
3.2 DEFINED AIR TRADE AREA

As shown in **Figure 3-1**, the Catchment Area for RTS includes an Air Trade Area and a larger Secondary Market. The Air Trade Area is defined as the area immediately surrounding RTS, whose population and economic activity generate the majority of the airport's aviation activity. This area includes Carson City and the following counties: Washoe, Storey Douglas, Lyon, and Churchill.

The Secondary Market includes the following counties in California: El Dorado, Lassen, Nevada, Placer, Plumas, and Sierra. Although the secondary market represents the uniqueness of Reno and the influences that the adjacent state of California has on population growth and other factors of the regional economy, it is not the primary source of activity generated at RTS. The demographic and economic data utilized to project future activity at RTS will focus on the Air Trade Area of the Catchment Area so as to allow this forecast to remain consistent with the forecast methodology described in the *Reno-Tahoe International Airport (RNO) Master Plan Update* completed in 2005.

3.3 DEMOGRAPHIC AND ECONOMIC DATA

The socio-economic characteristics of the surrounding community and overall region are important factors in estimating the demand for aviation services at an airport and evaluating the overall opportunity for future development. Population demographics, in addition to employment and earnings statistics, provide indications of the community's ability to support aviation activities over an extended period of time. The statistical link between these social and economic indicators can be used to gauge the overall



Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 2_Fig3-1-DCA_FIG_3-2_MSA.dwg Apr07,2010 - 10:35am

PBS&J

Master Plan Update
Reno-Stead Airport
Reno, Nevada

Defined
Catchment Area

Figure
3-1

community demand for aviation services and is often used to support aviation activity forecasts and airport development planning. Thus, a variety of historical and forecast socio-economic characteristics were obtained for use in the RTS Master Plan Update (Master Plan). The socioeconomic factors that were evaluated include historical and projected levels of population, employment, total earnings, and per capita income.

3.3.1 Population

The size and changes of local population often relate directly to the size of the pilot population and extent of aircraft ownership within a given market. Historical and projected levels of population in Washoe County, the Air Trade Area, the State of Nevada, and the United States are summarized in **Table 3-1** and illustrated in **Figure 3-2**. The population in Washoe County has increased at an average annual growth rate of 2.8 percent from 1990 to 2008. The overall population in the Air Trade Area has increased at an average annual growth rate of 2.9 percent from 1990 to 2008, a rate more than twice the national average of 1.1 percent. The State of Nevada grew fastest at a rate of 4.5 percent during the same period. The state's and county's continued strong population growth is due mainly to a high rate of net migration (particularly from California). The major reasons for net migration into Nevada include job opportunities and lower cost of living.

Projections of future population levels obtained for the period 2010 through 2030 indicate that the state population is expected to continue to experience a steady 2.0 percent annual average growth rate. Washoe County and the Air Trade Area are also projected to continue to experience a similar increase in population through 2030. All three, the county, state, and Air Trade Area are projected to grow significantly faster than the national average.

3.3.2 Employment

The level of employment provides another perspective into the economic stability of a given geographic area and the propensity for aviation. The historical and projected levels of employment for Washoe County, the Air Trade Area, the State of Nevada, and the United States are summarized in **Table 3-2** and illustrated in **Figure 3-3**. Historical growth in employment in Washoe County between 1990 and 2008 was robust with an average annual growth rate of 2.8 percent. Employment levels in the Air Trade Area have also steadily increased at the same average annual growth rate during this period. The State of Nevada outpaced the United States, Air Trade Area, and Washoe County with an average annual growth rate of 4.1 percent.

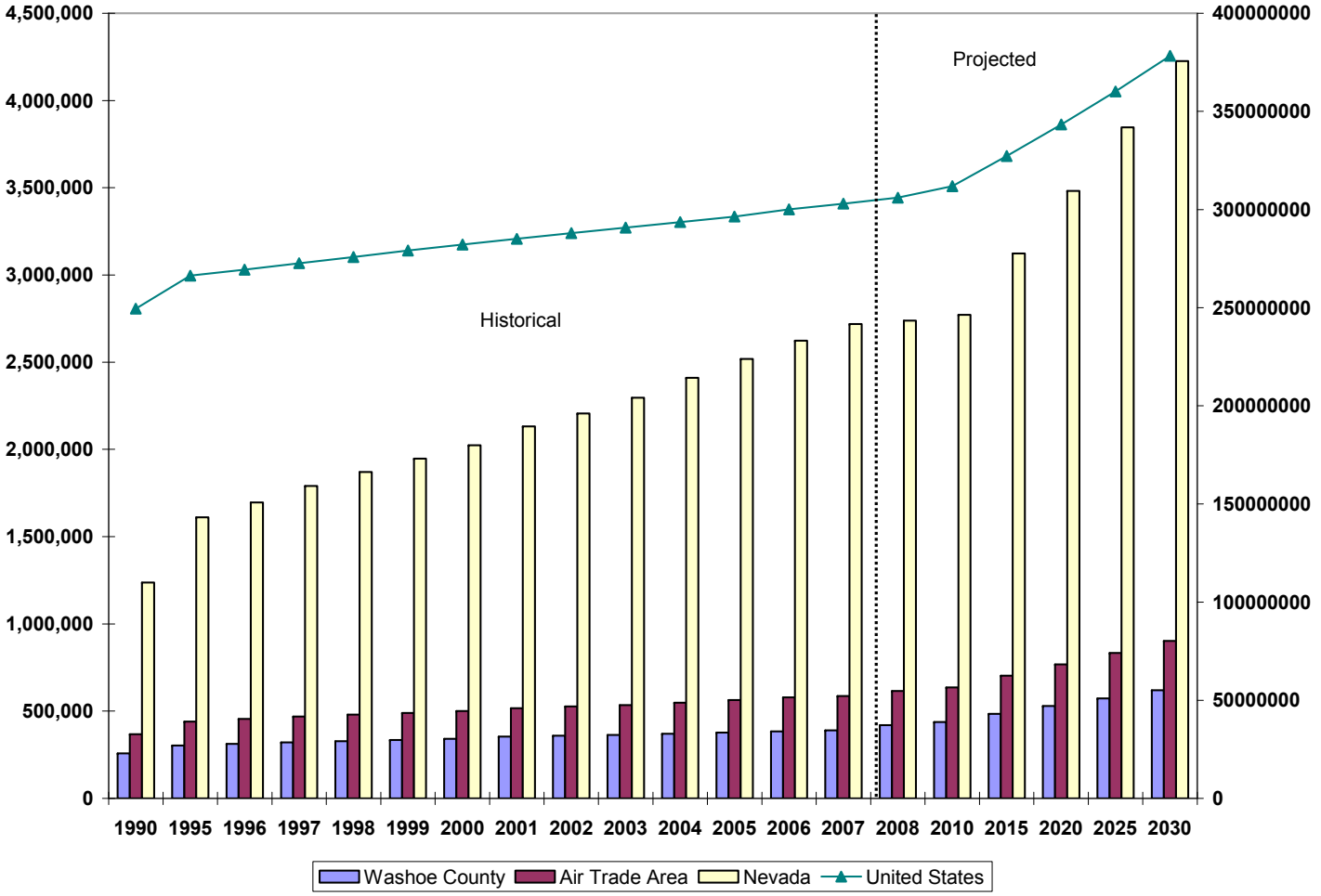
Projections of future employment levels obtained for the period 2010 through 2030 indicate that state employment is expected to continue to experience a 2.4 percent annual average growth rate. The Air Trade Area is also projected to continue to experience an increase in employment with an average annual growth rate of 1.9 percent through 2030. Both the state and Air Trade Area are projected to grow significantly faster than the national average.

Table 3-1. Historical and Projected Population

Year	Washoe County	Air Trade Area	Nevada	United States
Historical				
1990	259,680	367,390	1,236,130	249,438,712
1995	306,219	440,455	1,611,593	266,278,393
1996	315,956	455,623	1,696,405	269,394,284
1997	324,438	468,673	1,790,207	272,646,925
1998	331,485	479,216	1,870,881	275,854,104
1999	338,183	489,702	1,946,366	279,040,168
2000	345,426	500,150	2,023,378	282,193,477
2001	356,985	516,863	2,132,498	285,107,923
2002	363,062	526,011	2,206,022	287,984,799
2003	367,326	544,844	2,296,566	290,850,005
2004	374,127	561,951	2,410,768	293,656,842
2005	380,902	583,513	2,518,869	296,410,404
2006	383,330	578,313	2,623,050	300,085,843
2007	389,650	587,145	2,718,337	303,041,121
2008	419,037	615,953	2,738,733	305,995,488
Forecast				
2010	437,439	607,908	3,087,428	311,843,984
2015	483,803	658,558	3,605,713	327,290,594
2020	528,654	708,093	4,001,520	343,338,608
2025	573,332	757,532	4,315,334	360,186,639
2030	620,323	827,623	4,603,219	378,302,736
Average Annual Growth Rates				
1990-2008	2.8%	2.9%	4.5%	1.1%
2008-2030	1.8%	1.7%	2.0%	1.0%

Sources: Nevada Small Business Development Center, State of Nevada Demographer, Washoe County Consensus Forecast 2003-2025/2008-2030, Woods & Poole Economics.

Figure 3-2. Historical and Projected Population



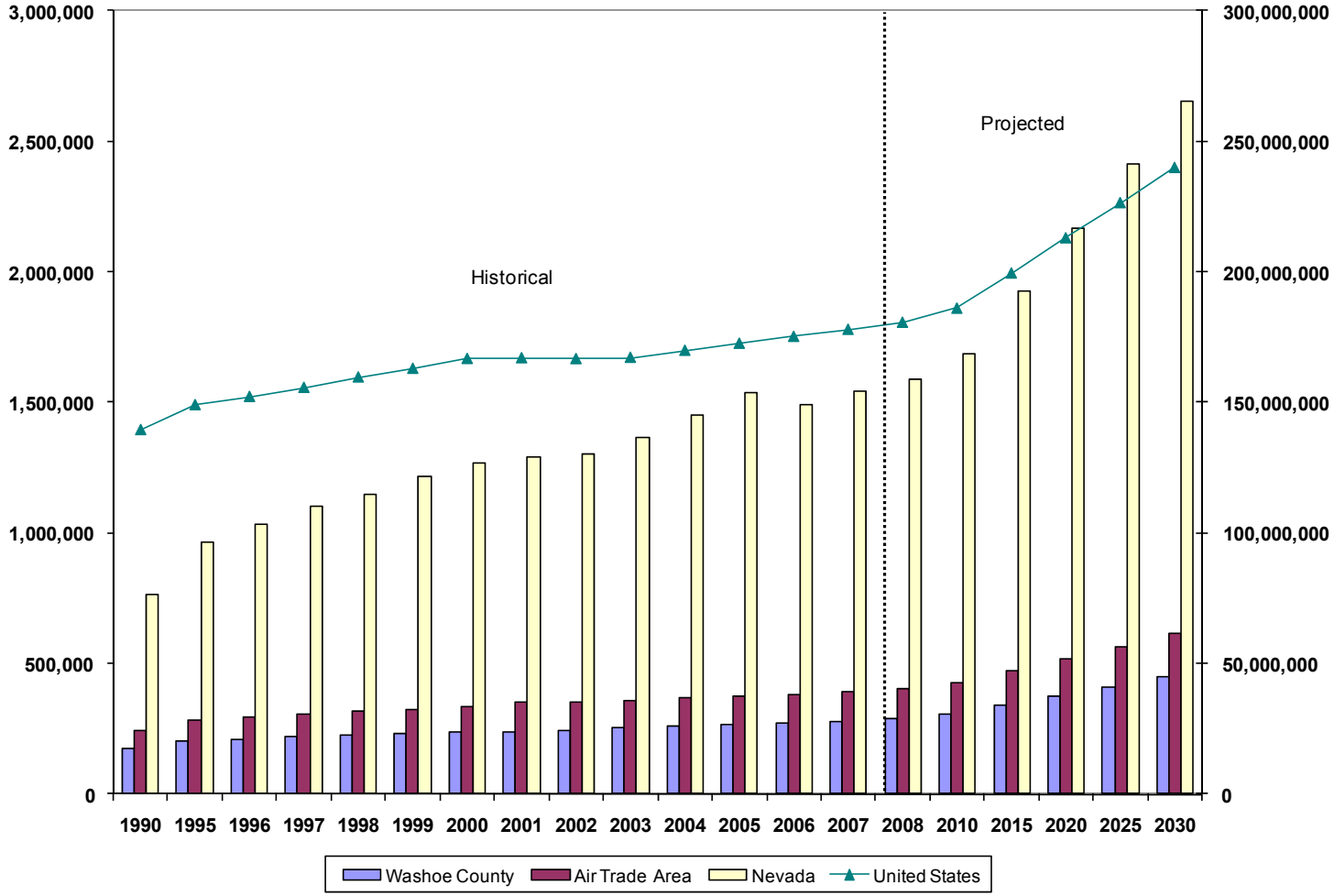
Sources: Nevada Small Business Development Center, State of Nevada Demographer, Washoe County Consensus Forecast 2003-2025/2008-2030, Woods & Poole Economics.

Table 3-2. Historical and Projected Employment

Year	Washoe County	Air Trade Area	Nevada	United States
Historical				
1990	176,480	245,420	766,439	139,380,891
1995	202,070	283,880	963,957	148,982,794
1996	210,670	295,820	1,035,389	152,150,190
1997	219,030	308,410	1,101,531	155,608,203
1998	226,120	317,200	1,145,198	159,628,186
1999	230,700	325,950	1,214,618	162,955,270
2000	238,760	337,700	1,267,998	166,758,782
2001	240,280	351,020	1,288,793	167,014,631
2002	240,990	352,160	1,303,589	166,699,004
2003	256,010	349,320	1,363,363	167,174,328
2004	261,650	356,560	1,449,791	169,880,573
2005	267,100	363,810	1,537,864	172,587,009
2006	272,440	382,620	1,493,404	175,246,102
2007	277,860	390,370	1,541,894	177,954,540
2008	291,360	406,200	1,590,345	180,663,082
Forecast				
2010	304,640	414,140	1,687,153	186,079,920
2015	338,685	451,560	1,928,661	199,622,184
2020	373,960	488,320	2,169,687	213,164,406
2025	410,670	524,530	2,410,583	226,706,689
2030	449,883	568,557	2,651,713	240,248,993
Average Annual Growth Rates				
1990-2008	2.8%	2.8%	4.1%	1.5%
2008-2030	2.0%	1.9%	2.4%	1.3%

Sources: Washoe County Consensus Forecast 2003-2025/2008-2030, Woods & Poole Economics.

Figure 3-3. Historical and Projected Employment



Sources: Washoe County Consensus Forecast 2003-2025/2008-2030, Woods & Poole Economics.

3.3.3 Total Earnings

Earnings are also a strong predictive element for general aviation demand. The category Earnings is compensation paid to workers and is not a measure of company earnings or profits. This category includes wages, salaries, and other income, and proprietors' income. The category also includes personal contributions for social insurance (social security, unemployment). Earnings data is recorded by place of work, so that earnings of an employee who works in one county or state but resides in another are recorded in the county/state where the job is. It should be noted that all earnings, income, and retail sales data is shown in constant 1996 dollars to show real levels adjusted for inflation and remain consistent with the Washoe County Consensus Forecasts and Woods and Poole economics data. This adjustment of current dollar information to a comparison of constant dollar amounts creates an "apples to apples comparison" of real economic growth over the period.

Historical and projected earnings for Washoe County, the Air Trade Area, the State of Nevada, and the United States are summarized in **Table 3-3** and illustrated in **Figure 3-4**. The earnings of both the residents of Washoe County and the Air Trade Area have increased at an average annual growth rate of 3.8 percent from 1990 to 2008. During this same period the State of Nevada grew at an average annual growth rate of 5.6 percent while earnings for the entire United States grew at 2.8 percent annually.

Projections of future earnings obtained for the period 2010 through 2030 indicate that the state earnings are expected to continue to experience a 3.9 percent annual average growth rate. The Air Trade Area is also projected to continue to experience an increase in earnings with an average annual growth rate of 2.4 percent through 2030. Again, both the state and Air Trade Area are projected to grow faster than the national average.

3.3.4 Per Capita Income

Per capita income can be a valuable indication of the economic conditions for a particular area. Strong income coupled with strength in overall employment levels and specific categories of employment are needed to support both business and recreational aircraft ownership and use. Historical and projected per capita income for Washoe County, the Air Trade Area, the State of Nevada, and the United States are summarized in **Table 3-4** and illustrated in **Figure 3-5**. Washoe County grew at an average annual growth rate of 2.7 percent from 1990 to 2008. The Air Trade Area grew at an average annual growth rate of 2.5 percent from 1990 to 2008. The State of Nevada and United States grew at approximately half that rate during the same timeframe with only 1.3 and 1.5 percent, respectively.

Table 3-4 also shows another positive vantage point relative to per capita personal income. Historically per capita income in the Air Trade Area averaged approximately 113 percent of that of the United States in the period from 1990 to 2008. The historical Air Trade Area per capita income is also higher than that of the State of Nevada's during the same time period, averaging just over 109 percent.

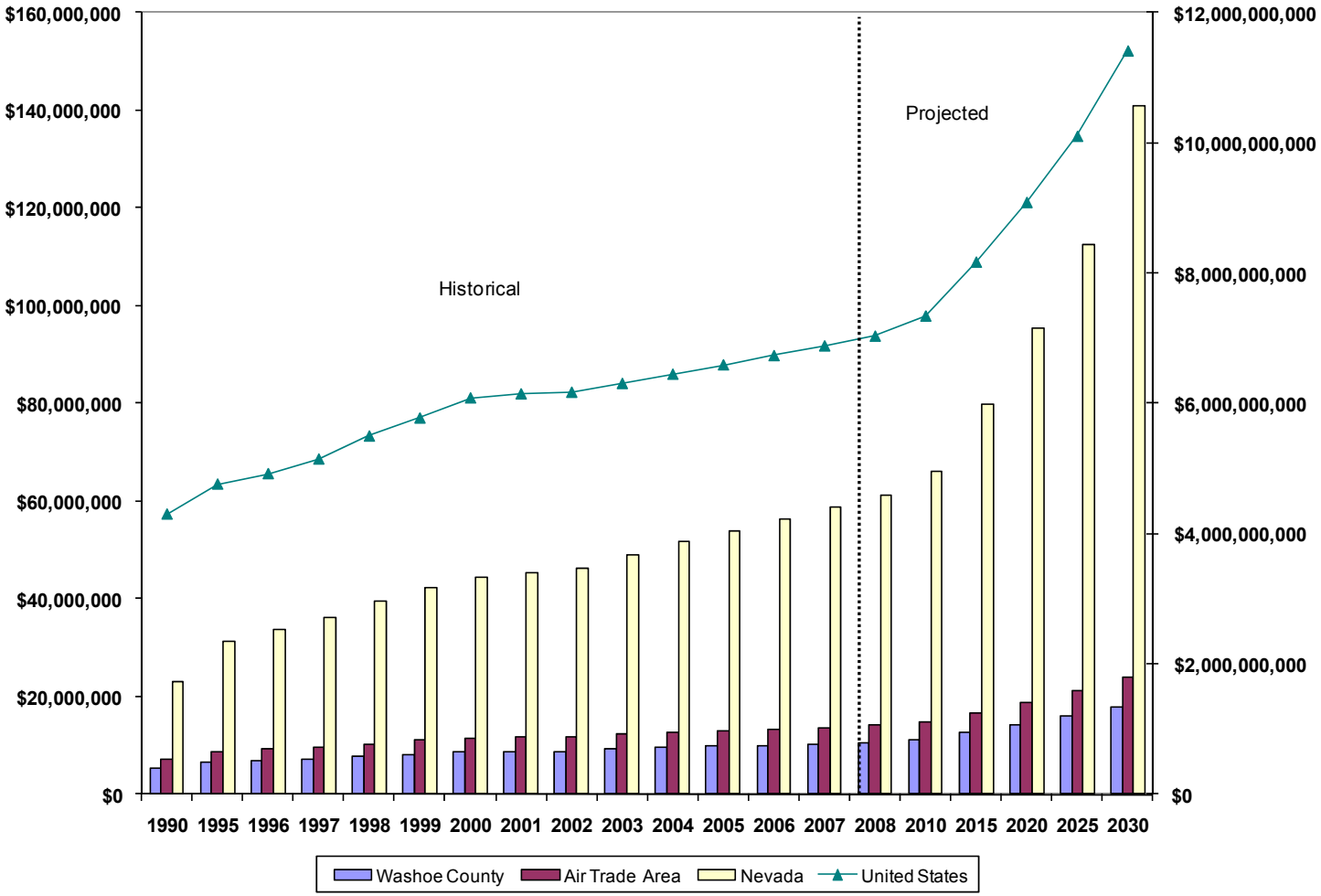
Projections of future per capita income obtained for the period 2010 through 2030 indicate that the state earnings are expected to continue to experience only a 1.1 percent average annual growth rate. Meanwhile, the Air Trade Area is projected to continue to experience a very strong average annual growth rate of 2.4 percent through 2030, about double the State of Nevada and United States rates.

Table 3-3. Historical and Projected Earnings (in thousands)

Year	Washoe County	Air Trade Area	Nevada	United States
Historical				
1990	$5,361,600	$7,159,870	$23,139,751	$4,302,268,000
1995	$6,493,400	$8,759,860	$31,246,050	$4,762,703,000
1996	$6,826,010	$9,193,100	$33,786,820	$4,922,925,000
1997	$7,144,670	$9,640,770	$36,101,330	$5,147,021,000
1998	$7,659,590	$10,341,490	$39,411,577	$5,498,691,000
1999	$8,210,440	$11,027,330	$42,413,527	$5,776,253,000
2000	$8,572,020	$11,475,010	$44,342,640	$6,084,932,000
2001	$8,845,150	$11,775,200	$45,344,294	$6,146,426,000
2002	$8,784,060	$11,736,910	$46,109,836	$6,171,591,000
2003	$9,191,240	$12,269,290	$48,975,602	$6,306,578,000
2004	$9,540,150	$12,695,310	$51,670,898	$6,448,721,000
2005	$9,792,970	$13,035,960	$54,000,349	$6,591,930,000
2006	$10,048,170	$13,380,060	$56,376,334	$6,733,971,905
2007	$10,308,430	$13,731,210	$58,787,303	$6,883,258,792
2008	$10,569,040	$14,082,980	$61,219,211	$7,032,836,482
Forecast				
2010	$11,106,030	$14,808,240	$66,251,343	$7,341,134,000
2015	$12,546,010	$16,755,290	$79,900,799	$8,168,481,000
2020	$14,137,970	$18,910,340	$95,277,714	$9,084,387,000
2025	$15,899,330	$21,296,490	$112,656,797	$10,099,791,000
2030	$17,849,320	$23,939,830	$141,063,879	$11,409,260,000
Average Annual Growth Rates				
1990-2008	3.8%	3.8%	5.6%	2.8%
2008-2030	2.4%	2.4%	3.9%	2.2%

Note: All figures presented in 1996 dollars.
Sources: Nevada Small Business Development Center, State of Nevada Demographer, Washoe County Consensus Forecast 2003-2025/2008-2030, Woods & Poole Economics.

Figure 3-4. Historical and Projected Earnings (in thousands)



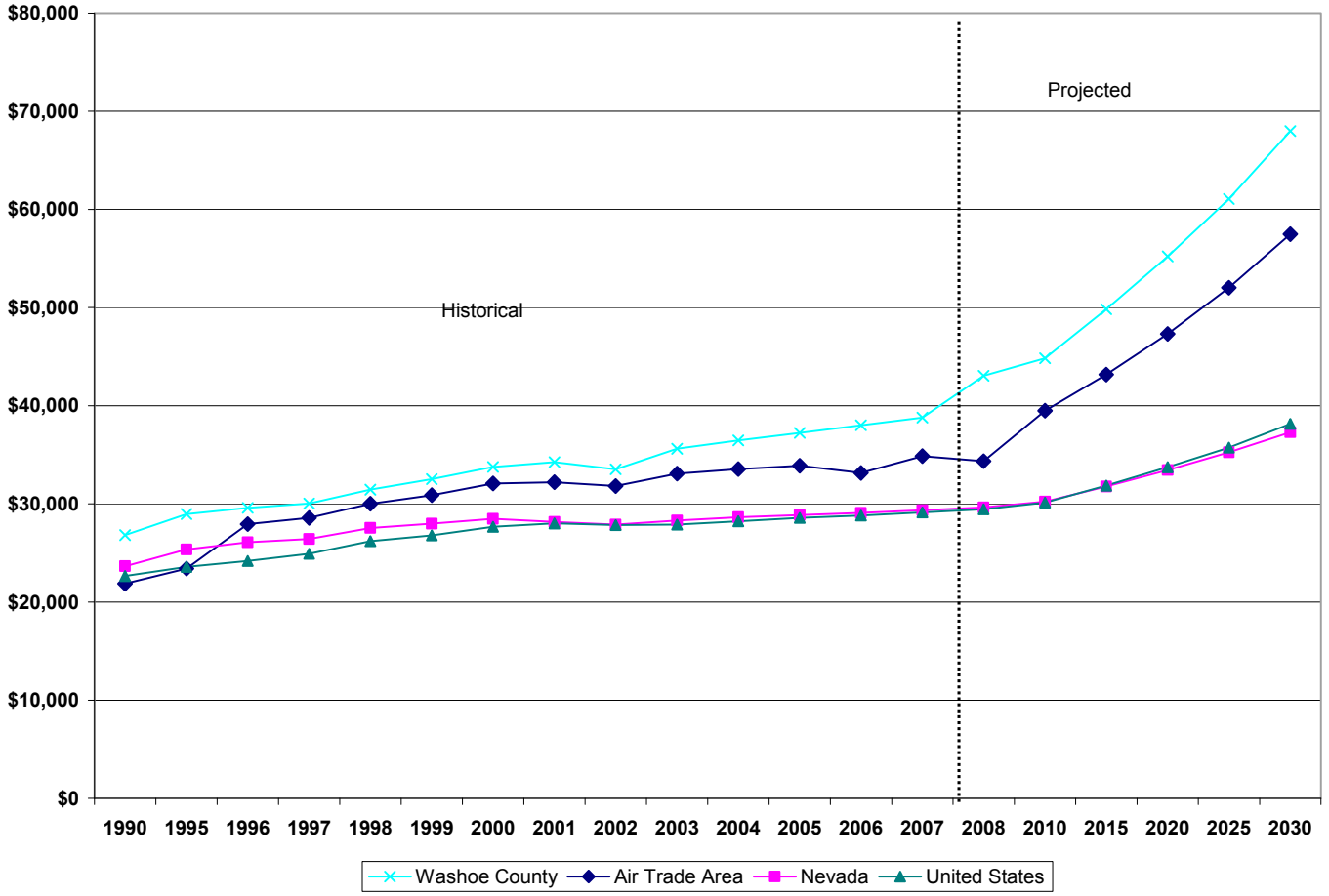
Note: All figures presented in 1996 dollars.
Sources: Nevada Small Business Development Center, State of Nevada Demographer, Washoe County Consensus Forecast 2003-2025/2008-2030, Woods & Poole Economics.

Table 3-4. Historical and Projected Per Capita Income

Year	Washoe County	Air Trade Area	Nevada	United States	Air Trade Area % of NV Population	Air Trade Area % of US Population
Historical						
1990	$26,806	$21,871	$23,645	$22,634	92.5%	96.63%
1995	$28,949	$23,396	$25,351	$23,573	92.3%	99.25%
1996	$29,599	$27,937	$26,085	$24,175	107.1%	115.56%
1997	$30,032	$28,579	$26,417	$24,914	108.2%	114.71%
1998	$31,448	$30,014	$27,544	$26,202	109.0%	114.55%
1999	$32,515	$30,884	$27,979	$26,786	110.4%	115.30%
2000	$33,770	$32,067	$28,473	$27,655	112.6%	115.96%
2001	$34,244	$32,196	$28,155	$28,015	114.4%	114.93%
2002	$33,527	$31,805	$27,883	$27,826	114.1%	114.30%
2003	$35,610	$33,079	$28,296	$27,895	116.9%	118.59%
2004	$36,460	$33,540	$28,643	$28,228	117.1%	118.82%
2005	$37,230	$33,879	$28,865	$28,562	117.4%	118.62%
2006	$38,010	$33,140	$29,070	$28,805	114.0%	115.05%
2007	$38,780	$34,856	$29,353	$29,130	118.7%	119.66%
2008	$43,041	$34,356	$29,638	$29,456	115.9%	116.63%
Forecast						
2010	$44,832	$39,498	$30,235	$30,133	130.6%	131.08%
2015	$49,823	$43,165	$31,772	$31,869	135.9%	135.45%
2020	$55,217	$47,320	$33,440	$33,736	141.5%	140.27%
2025	$61,058	$52,012	$35,235	$35,734	147.6%	145.55%
2030	$67,975	$57,473	$37,301	$38,143	154.1%	150.68%
Average Annual Growth Rates						
1990-2008	2.7%	2.5%	1.3%	1.5%		
2008-2030	2.1%	2.4%	1.1%	1.2%		

Note: All figures in 1996 dollars.
Sources: Nevada Small Business Development Center, State of Nevada Demographer, Washoe County Consensus Forecast 2003-2025/2008-2030, Woods & Poole Economics.

Figure 3-5. Per Capita Income



Note: All figures in 1996 dollars.
Sources: Nevada Small Business Development Center, State of Nevada Demographer, Washoe County Consensus Forecast 2003-2025/2008-2030, Woods & Poole Economics.

3.4 METHODOLOGY

Various methods of forecasting aviation demand exist and are widely used throughout the industry. Trend line analysis examines cycles of historical aviation activity and uses mathematical techniques to extrapolate these historic trends into the future. Regression analysis is a statistical technique that ties aviation demand to economic measures. Market share analysis is a technique that assumes a top-down relationship between national, regional, and local forecasts. Local forecasts are a market share percentage of regional or national forecasts. Operations per based aircraft (OPBA) is a ratio used to compare based aircraft and operations, one value divided by another. All of these forecasting techniques as well as influences unique to the region were considered in projecting aircraft activity for RTS and are reflected in the selected forecasts. These methods will be discussed in greater detail throughout this chapter.

3.5 FORECASTING TRENDS AND CONSIDERATIONS

In preparing a forecast of aviation demand for RTS, it is important to have a general understanding of the events and trends that are influencing the aviation industry as a whole and general aviation in particular. National general aviation trends can provide some insight into the growth potential at RTS. State, regional, and local economic and business trends along with demographic changes can also assist in the development of more accurate aviation demand forecasts for RTS. These trends are discussed below.

3.5.1 National General Aviation Trends

Following more than a decade of decline, the general aviation industry was revived with the passage of the General Aviation Revitalization Act of 1994 (GARA), which limited manufacturer's product liability on general aviation aircraft to 18 years. This legislation encouraged firms such as Cessna and Piper Aircraft to re-enter the single-engine piston aircraft manufacturing sector. GARA's positive impacts on the national GA industry since its passage are currently reflected in several GA activity statistics. Since 1994, activity statistics indicate an increase in GA operations at Federal Aviation Administration (FAA) air traffic controlled facilities, an increase in the active GA aircraft fleet size, and record shipments and billings of fixed-wing GA aircraft.

However, the positive growth and outlook for the general aviation industry was affected to a degree by the terrorist attacks on September 11, 2001 coupled with that of an economic recession that began in early 2001. In the past few years the general aviation industry has demonstrated mixed signs of recovery, but the long-term projection is still one of growth. GA's positive future is attributed to the following:

- Continued growth in business and corporate use of general aviation;
- Innovative ways of sharing the cost of aircraft ownership and/or new ways of accessing business aircraft;
- The potential expanded use of general aviation as an alternative to commercial passenger airline use by corporate travelers;
- Industry promotion of learn-to-fly programs, including the introduction of the Sport Pilot License;
- The introduction of light sport aircraft (LSA) and very light jet (VLJ) aircraft, consisting of relatively inexpensive one and two engine jet aircraft;

- The future role of the Small Aircraft Transportation System (SATS) in the United States; and
- Continued advancement of avionics and computer technology.

Specific trends related to GA activity, as identified in the FAA Aerospace Forecasts, Fiscal Years 2007-2020 and other national resources are identified below. These trends are discussed in terms of the number of aircraft shipments and billings, active fleet, and hours flown.

3.5.1.1 Active Shipments and Billings

The General Aviation Manufacturers Association (GAMA) tracks and reports total shipments and billings of general aviation aircraft. GAMA statistics for 2006 indicate continued growth of the general aviation aircraft manufacturing industry. During 2006, general aviation aircraft shipments totaled 4,042, an increase of approximately 12.9 percent over 2005. Estimated billings for new manufactured general aviation shipments in 2006 totaled $18.8 billion dollars, an increase of 24.1 percent over 2005.

3.5.1.2 Active GA Fleet

In 2006, the FAA estimated that there were 226,422 active general aviation aircraft. The growth of the active general aviation aircraft fleet is forecast to increase by an annual average rate of 1.4 percent through 2020, growing to 274,914 in 2020. Single-engine piston aircraft (including helicopters) will continue to be the dominant aircraft in the GA fleet mix but are expected to grow at only about 0.30 percent overall per year through 2020. The more expensive, turbine-powered fleet (including helicopters) is projected to grow at an average annual rate of 3.6 percent through 2020 with the turbine jet fleet increasing at 6.0 percent per year. FAA attributes the growth of turbine aircraft to the success of fractional ownership, the introduction of new types of turbine aircraft that have piqued buyer interest, strong U.S. and global economies, and a transition from commercial air travel to corporate/business air travel by many business travelers and corporations.

The FAA also assumes that relatively inexpensive VLJs as well as new light sport aircraft could dilute or weaken the replacement market for piston-engine aircraft. The FAA/Transportation Research Board Business Aviation Panel has suggested that the market for VLJs could add an additional 6,300 of these aircraft to the general aviation fleet by 2020.

3.5.1.3 Hours Flown

The number of general aviation hours flown is projected to increase by 3.4 percent annually from 27,543,000 in 2006 to 43,860,000 in 2010. Much of the increase reflects increased flying by business and corporate aircraft as well as steady, if relatively small, annual percentage increases in utilization rates for piston aircraft. Hours flown by turbine aircraft (including helicopters) are forecast to increase 6.1 percent annually over the forecast period, compared to the 1.3 percent for piston-powered aircraft. Jet aircraft are forecast to account for most of the increase, with hours flown expanding at an average annual rate of 9.4 percent over the forecast period. The large increases in jet hours result from the introduction of very light jets and increases in the fractional ownership fleet.

3.5.1.4 Active Pilots

Between 2000 and 2006, the total number of active general aviation pilots has declined and the FAA is projecting that this decline will continue through the year 2010. However, between 2010 and 2020, the FAA is projecting the number of active general aviation pilots (excluding air transport pilots) to increase at an average annual rate of 1.2 percent. Critical to general aviation and the aviation industry as a whole are the number of student pilots. In 2006, the number of student pilots decreased by 2.7 percent. However, the number of student pilots is projected to increase from 84,866 in 2006 to 100,181 in 2020, an average annual rate of 1.2 percent. The largest existing and projected growth is in the sport pilot category. As of December 31, 2007, the number of sport pilot certificates issued was 939. FAA is projecting that 16,252 new sport pilots will be certified during the forecast period, an average annual increase of 22.6 percent.

3.5.2 Regional and Local Trends

The long-term outlook for the State of Nevada economy remains one of strong, steady growth and expansion. As highlighted earlier in this chapter, the population, employment, earnings, and per capita income of Washoe County and the defined Air Trade Area have grown at significantly faster rates than the national growth rate from 1990 to 2008, and future projections continue this trend. This increase is a result of people and businesses relocating into the region, primarily from California. Regional growth factors and the strength of the local economy are important considerations and influences in projecting future aviation demand at RTS. Therefore, a brief discussion of the area's unique blend of factors such as the quality of life, market access, favorable tax climate, business-friendly climate, and tourism are discussed below.

3.5.2.1 Quality of Life

Northern Nevada's natural beauty and distinctive four-season climate offer almost every type of recreational activity. The majestic Sierra Nevada mountain range forms the western boundary of the Truckee Meadows, featuring alpine and Nordic skiing at 18 major resorts. Fishing, sailing, swimming, hiking, biking, camping, and horseback riding are all exceptional. A quick escape is easy with more than 39 golf courses. The Reno-Sparks-Tahoe area is the cultural center of the Sierras. The "Biggest Little City" also offers many diverse options in the performing, visual, and literary arts. Northern Nevada offers over 100 residential subdivisions offering homes in the price range of $120,000 to $500,000. There are many neighborhoods featuring different types of architecture from old, charming historical houses to modern styles. In a quick comparison to areas of comparable population, northern Nevada is right on par when it comes to cost of living. Reno-Sparks has consistently rated among the most affordable and "hottest" cities in the region.

3.5.2.2 Location and Market Access

Nevada offers great highway and air accessibility to the major western markets and is strategically located as the hub of the 11-state western region. The area is well suited to provide distribution, warehouses, or other support business services to markets in Nevada, California, Oregon, Washington, Idaho, and Utah. Reno is located four hours from the major international and domestic shipping hub of the San Francisco Bay Area. The proximity to major West coast ports provides next day capability for movement of cargo back and forth for import and export as well as domestic spoke-and-hub services via air, truck, or rail. The area also represents an ideal location for parts, supply,

assembly, or other industrial services to support businesses in the western United States.

3.5.2.3 Favorable Tax Environment

Because a majority of tax revenues in Nevada are generated from the tourism and gaming industries, Nevada's tax burden is one of the lightest in the nation. Nevada is one of only seven states without a personal income tax and one of only three without a corporate income tax. In addition, Nevada does not have unitary, franchise or inventory tax, inheritance tax, or estate and/or gift tax. It is this tax structure that has allowed Nevada to rank as number three of the 10 best states in the "Tax Foundation's 2008 State Business Tax Climate Index."

3.5.2.4 Business Friendly Climate

The State of Nevada and various units of government within Nevada, as well as private utilities and regional development associations, offer various tax and other incentives/assistance for new or expanding businesses. These tax incentives for new or expanding businesses are in addition to the already relatively low taxes within Nevada. This generally pro-growth and pro-business attitude is in contrast to some other western states. These tax incentive or relocation assistance packages are in addition to the basic attributes necessary to locate a business in western Nevada such as available land, adequate infrastructure (e.g. roads, utilities), trained labor force, etc. Environmental laws are also generally favorable for industrial, retail/commercial, residential development within Nevada. Within the past few years, magazines such as Forbes, Time, and Inc. have cited Nevada as one of the best states in the country for jobs and business growth.

3.5.2.5 Tourism

The Reno-Tahoe region is described as "America's Adventure Place." In addition to the area's breath-taking beauty, Reno and Lake Tahoe offers an amazing mix of history, art, and culture. The Reno-Tahoe area has world-class ski and snowboarding resorts, major golf courses, 24-hour gaming, entertainment, and rich night life.

Tourism is the major industry in the Reno area. The hotel and casino industry attracts more than five million visitors annually and adds over $4 billion to the local economy each year. Reno Annual Events include Hot August Nights, Reno Tahoe Open, Tahoe-Reno International Film Festival, and Reno Balloon Races. The National Championship Air Races and Air Show has been held at RTS every year since 1964. The event draws fans from all over the world, including a large local following, and brings millions of dollars to the regional economy each year.

The Reno-Sparks Convention & Visitors Authority owns and operates a number of facilities to support tourism. After a recent expansion and renovation, the Reno-Sparks Convention Center now offers over 500,000 square feet of meeting/exhibition space and 46 meeting rooms, plus a 30,000 square foot multi-purpose ballroom. The Reno Events Center opened in downtown Reno in early 2005. This 7,000 seat multi-purpose center provides additional convention and meeting space to attract industry conventions, business meetings, and shows. Reno is unique in having the only bowling stadium designed exclusively for bowling tournaments. This 78 lane facility opened in 1995. A new agreement with the American Bowlers Congress assures tournaments in Reno for two out of every three years through 2018.

Triple-A Baseball has also come to Reno with the first game played by the Reno Aces in April of 2009. The new stadium has seating for 10,000 and is located along the Truckee

River at the historic Freight House site. SK Baseball purchased the Tucson, Arizona Sidewinders and brought the team to Reno. SK Baseball is working with a retail developer to create a retail/entertainment district, named the Freight House District, which will surround the stadium.

Major outdoor retailers are also catching on to the recreational treasure located in Reno. Retailers such as Cabela's, Scheels and Bass Pro Sports have built or are in the process of constructing mega-stores in the Reno-Sparks area. These stores are not only expected to provide more jobs and economic stimulation but are expected to become major tourist draws.

It is due to the above regional growth factors and influences that the area will continue to grow and prosper as more people and businesses flee the high cost of living, high taxes, and congestion of California to Nevada. This has and will continue to produce a positive impact on the growth of aviation activity at RTS.

3.6 BASED AIRCRAFT FORECAST

A projection of GA aircraft that will be based at RTS is required for the proper planning of future airside and landside requirements, such as runway usage, aircraft parking apron, and the number of hangars needed. The historical based aircraft data was obtained primarily from the Federal Aviation Administration's (FAA) Terminal Area Forecast (TAF), 2007. The data was also compared against based aircraft counts presented in the *1994 Airport Development Plan* for the Reno-Stead Airport prepared by Coffman Associates, Inc., as well as the data in the *Nevada Airport System Plan Update* prepared for the Nevada Department of Transportation by Aries Consultants Ltd., September 2004. All sources have areas of incomplete or inconsistent data. **Table 3-5** shows the compiled and smoothed historical based aircraft data that is used in creating this report's forecasts. The forecast of Based Aircraft was developed using four forecasting techniques as described below.

3.6.1 Trend Line Analysis

Trend Line analysis examines historical growth trends in activity and applies these trends to current demand levels to produce projections of future activity. Trend line analysis assumes that activity, and the factors that have historically affected activity, will continue to influence demand levels at similar rates over an extended period of time. Linear trend projections are typically used to provide baseline forecasts that reflect stable market conditions.

Table 3-5. Historical Based Aircraft

Year	1994 Airport Development Plan	FAA TAF	Nevada Airport System Plan	Derived Historical Based Aircraft
1990	n/a	205	n/a	209
1991	154	181	n/a	215
1992	150	170	n/a	219
1993	154	170	n/a	221
1994	n/a	171	n/a	225
1995	161	216	n/a	227
1996	n/a	216	n/a	228
1997	n/a	216	n/a	229
1998	n/a	216	n/a	230
1999	n/a	216	n/a	235
2000	183	216	231	241
2001	247	231	233	247
2002	249	258	235	249
2003	250	261	237	250
2004	255	262	240	255
2005	205	262	243	258
2006	258	264	245	261
Average Annual Growth Rates				
1990-1995	n/a	1.1%	n/a	1.7%
1995-2000	2.6%	0.0%	n/a	1.2%
2000-2006	7.1%	3.4%	1.2%	1.3%

Note: Derived Historical Based Aircraft were calculated by averaging the results of a single variable regression analysis of socioeconomic elements.
Sources: 1994 Airport Development Plan (Coffman Associates), FAA Terminal Area Forecast, 2007, Nevada Airport System Plan Update, 2004, and PBS&J, 2009.

As shown in **Table 3-6**, based aircraft at RTS grew at an average annual growth rate of 1.4 percent from 1990 to 2006. The Trend Line Analysis indicates that the number of based aircraft at RTS is expected to grow at an average annual rate of 1.4 percent during the planning period to 364 based aircraft by the year 2030.

3.6.2 Regression Analyses

The demographic and economic elements of the surrounding community are among the principal factors in forecasting the levels of aviation activity at an airport. Population demographics, in addition to employment and earnings statistics, provide indications of the community's ability to support aviation activities and of the underlying level of demand for aviation services.

Regression analysis refers to a technique for studying and comparing relationships between various socioeconomic independent variables (population, employment, per capita income, etc.) and dependent variables (based aircraft and/or operations). The coefficient of determination (r2) is a statistical measure showing the extent to which

Table 3-6. Trend Analysis Results

	Year	Based Aircraft
Historical		
	1990	209
	1991	215
	1992	219
	1993	221
	1994	225
	1995	227
	1996	228
	1997	229
	1998	230
	1999	235
	2000	241
	2001	247
	2002	249
	2003	250
	2004	255
	2005	258
	2006	261
Forecast		
	2010	276
	2015	296
	2020	317
	2025	340
	2030	364
	Average Annual Growth Rates	
	1990-2006	1.4%
	2006-2030	1.4%

Note: Trend analysis of historical based aircraft from 1990 to 2006.
Source: PBS&J, 2009.

there is a relationship between the two variables. The closer the r^2 value is to 1.0, the higher the confidence level is that a change in the value of socioeconomic values would translate into a change in airport activity. As rule of thumb, an r^2 value over 0.95 carries a strong statistical correlation.

The regression modeling was based on demographic elements from the RTS Air Trade Area discussed earlier in this chapter. The RTS Air Trade Area socioeconomic data was used because that data most accurately reflects the impacts on based aircraft as a result of the large geographic catchment area that generates the majority of RTS's aviation activity. This analysis regressed individual elements of population, employment, earnings, and per capita income from historical data against the number of based aircraft to determine if a positive relationship existed that could serve as the basis for a forecast. As shown in **Table 3-7**, the four socioeconomic variables of population, employment, earnings, and per capital income produced r^2 values of 0.97, 0.28, 0.96, and 0.86, respectively. Overall, the regression methodology resulted in high correlations between population and earnings and based aircraft. As shown in Table 3-7, population and earnings projects based aircraft to increase to 314 and 337, respectively by the year 2030.

3.6.3 Market Share Analysis

The market share analysis methodology examines RTS's historical share of the national, state, and regional market. This approach assumes the growth in activity at the airport to be proportionate to the activity of the nation, state, and region. Therefore, as market shares are held constant over the forecast period, the resulting increases in the activity occur based on the growth rates established in the FAA's Aerospace Forecasts and TAF, 2007. As shown in **Table 3-8**, based aircraft are projected to increase at an average annual rate of 0.8 percent and reach 319 by 2030.

Table 3-7. Regression Analysis Results – Single Independent Variable

		Based Aircraft Projections			
Year	Based Aircraft	Population	Employment	Earnings	Per Capita Income
Historical					
1990	209				
1991	215				
1992	219				
1993	221				
1994	225				
1995	227				
1996	228				
1997	229				
1998	230				
1999	235				
2000	241				
2001	247				
2002	249				
2003	250				
2004	255				
2005	258				
2006	261				
Forecast					
2010		264	251	269	262
2015		276	257	284	273
2020		287	262	300	285
2025		298	267	318	299
2030		314	272	337	313
Average Annual Growth Rates					
1990-2006	1.4%				
2006-2030		1.2%	0.3%	1.6%	1.1%
R-Square		0.97	0.28	0.96	0.87

Sources: Nevada Small Business Development Center, State of Nevada Demographer, Washoe County Consensus Forecast 2003-2025/2008-2030, Wood & Poole Economics, PBS&J, 2009.

Table 3-8. Market Share Results

Year	Based Aircraft				Market Share		
	Western Pacific	State of Nevada	U.S. Total	Reno-Stead	RTS Share of Western Pacific Region	RTS Share of State of NV	RTS Share of US
Historical							
2001	36,700	2,545	189,569	247	0.7%	9.7%	0.1%
2002	36,747	2,436	191,412	249	0.7%	10.2%	0.1%
2003	37,058	2,456	192,779	250	0.7%	10.2%	0.1%
2004	36,905	2,361	195,759	255	0.7%	10.8%	0.1%
2005	37,920	2,415	199,813	258	0.7%	10.7%	0.1%
2006	38,193	2,526	201,070	261	0.7%	10.3%	0.1%
Forecast							
2010	39,440	2,591	207,142	270	0.7%		
2015	41,133	2,678	215,451	281	0.7%		
2020	42,944	2,775	224,599	293	0.7%		
2025	44,919	2,878	234,971	307	0.7%		
2030	46,744	2,950	245,737	319	0.7%		
Average Annual Growth Rate							
2001-2006	0.8%	-0.1%	1.2%	1.1%			
2006-2030	0.8%	0.6%	0.8%	0.8%			

Notes: FAA data in fiscal years, 2006 is estimated, data extrapolated from 2025 to 2030.

Sources: FAA Terminal Area Forecast, Fiscal Years 2006-2025 March 2007 and PBS&J, 2009.

3.6.4 Selected Based Aircraft Forecast

The selection of a preferred based aircraft forecast should be the best representation of what is expected to occur at RTS. All of the previously mentioned forecasting methods are good standard techniques used in the industry but each have certain limitations to truly predict activity in a dynamic and growing market. Each of these methodologies assume the future will be identical to the past and/or rely on a set of projections developed for another purpose. These projections do not fully account for the airport development that is currently underway, the positive growth influences of the local region, or the capacity and access challenges other airports in the region will face in the future.

As a result, the preferred based aircraft forecast for RTS utilizes the results of the methodologies discussed previously to establish a baseline projection which has then been adjusted to account for conditions/activities likely to influence the future. Since the regression analysis comparing population of the Air Trade Area to based aircraft yielded a very high correlation and produced a mid-range projection of the various techniques, it was chosen as the most appropriate to represent the baseline forecast. The following discussion describes the influencing factors and adjustments made to the baseline forecast to achieve the preferred based aircraft forecast presented in **Table 3-9** and used to determine future facility requirements.

New T-hangar units are currently being constructed at RTS. Based on the waiting list, Reno-Tahoe Airport Authority (RTAA) anticipates that the new T-hangar development will attract 50 new tenants/based aircraft over the next two years. As such, the selected based aircraft forecast reflects 25 new based aircraft in 2009 and 25 new aircraft in 2010.

An additional subjective factor of 0.25 percent was also applied to the based aircraft growth rate every five years from 2010 to 2030 in order to account for anticipated growth influences of the local economy as well as RTS's anticipated increase in market share within the region. For example, future capacity constraints at Reno-Tahoe International Airport will likely cause some GA aircraft to relocate to RTS. Comparable GA airports in proximity to RTS such as Truckee-Tahoe, Carson City, and Minden-Tahoe also have development constraints that will likely increase the market share at RTS. Truckee-Tahoe is surrounded by noise sensitive residential communities, and therefore has voluntary noise abatement procedures in effect. Carson City cannot obtain an Instrument Landing System (ILS) and recently could not obtain a Global Positioning System (GPS) approach. Both runways at Minden-Tahoe Airport have published gross weight limitations (30,000 pounds single wheel and 50,000 pounds dual wheel landing configurations). In addition, Minden-Tahoe has several voluntary noise abatement procedures in place. As these capacity and access challenges intensify at other airports in the future RTS, which has no such constraints, will play an ever-increasing role in serving the GA needs of the region.

As shown in Table 3-9**,** based aircraft are projected to increase at an average annual rate of 3.1 percent from 2006 to 2030, reaching 539 by the end of the planning period. The growth rate follows that of population plus influences of the local economy and potential increases in market share within the region.

Table 3-9. Selected Forecast of Based Aircraft

Year	Based Aircraft
Historical	
1990	209
1991	215
1992	219
1993	221
1994	225
1995	227
1996	228
1997	229
1998	230
1999	235
2000	241
2001	247
2002	249
2003	250
2004	255
2005	258
2006	261
Forecast	
2010	318
2015	356
2020	404
2025	464
2030	539
Average Annual Growth Rates	
1990-2006	1.4%
2006-2010	5.1%
2010-2015	2.3%
2015-2020	2.6%
2020-2025	2.8%
2025-2030	3.0%
2006-2030	3.1%

Sources: Reno Tahoe Airport Authority, Nevada Small Business Development Center, State of Nevada Demographer, Washoe County Consensus Forecast 2003-2025/2008-2030, Woods & Poole Economics, RTAA, and PBS&J, 2009.

3.7 FORECAST OF BASED AIRCRAFT – FLEET MIX

The forecast of based aircraft presented in **Table 3-9** was used to project the types of based aircraft (the fleet mix) that is expected at RTS. The current fleet mix (2006) was identified by aircraft class: single-engine piston, multi-engine piston, military (helicopters), civilian helicopters, turboprop, and jet aircraft. This information was sourced from RTS records and FAA Form 5010. The future fleet mix was projected by examining historical trends, available airport information, and national data for general aviation aircraft. As shown in **Table 3-10** the share of based single-engine aircraft are projected to increase throughout the planning period while the share of multi-engine aircraft at RTS is projected to decrease. The turboprop share of based aircraft is projected to remain relatively constant. Additionally, the share of based jet and helicopters at RTS is expected to increase during the planning period. These shares are consistent with the national GA industry trends described in Section 3.5. *The Master Plan for Nevada Army National Guard*, September 20, 2002 was reviewed to determine an estimate of growth for military based aircraft. Based military aircraft are projected to grow at an average annual rate of 3.2 percent from 2006 to 2030.

3.8 FORECAST OF AIRCRAFT OPERATIONS

The demand for general aviation facilities is typically expressed in terms of based aircraft, discussed in the previous section, and aircraft operations. The preparation of aviation operations forecasts is essential in assessing the needs and requirements for future aviation development and will serve as an overall planning guide for identifying airport capacity needs. The forecasts prepared in this section use 2006 as the baseline year, with projections extending to 2030 with the overall goal to provide the RTAA with reasonable aviation demand forecasts to assess the current and future capacities of RTS, as well as planning adjustments necessary to ensure that the facilities can meet the projected level of demand. The methodologies and underlying assumptions that are used to prepare the forecasts of aircraft operations for RTS are discussed in the following sections.

3.8.1 Total Operations

Forecasts of total operations were prepared using a ratio of aircraft operations to based aircraft from historical data. The OPBA is then applied to forecasts of based aircraft to develop estimates of future annual operations. This methodology is a common forecast technique because it directly links the aircraft to their average level of annual utilization at RTS.

As shown in **Table 3-11,** the historical OPBA has fluctuated since 1985 from a high of 306 to a low of 245. For the purposes of projecting future aircraft operations at the airport, it was assumed that the average of 1990-2006 estimated OPBA value of 273 is applied to the projected number of based aircraft. The number of total operations is projected to increase from 64,000 in 2006 to 147,148 in 2030, representing an average annual growth rate of 3.5 percent during the planning period.

Table 3-10. Forecast of Based Aircraft – Fleet Mix

Year	Single-Engine Piston	% of Total	Multi-Engine Piston	% of Total	Military	% of Total	Turbo Prop	% of Total	Jet	% of Total	Helicopter	% of Total	Total
2006	175	67.0%	23	8.8%	15	5.7%	2	.8%	19	7.3%	27	10.3%	261
Forecast													
2010	216	68.0%	23	7.3%	18	5.7%	2	.8%	25	7.6%	34	10.7%	318
2015	243	68.3%	23	6.6%	20	5.7%	3	.8%	28	7.8%	38	10.8%	356
2020	277	68.6%	23	5.7%	24	6.0%	3	.8%	33	8.0%	44	10.9%	404
2025	322	69.4%	22	4.7%	28	6.0%	4	.8%	37	8.1%	51	11.0%	464
2030	376	69.8%	22	4.1%	32	6.0%	4	.8%	45	8.3%	59	11.0%	539
Average Annual Growth Rates													
2006-2030	3.2%		-0.2%		3.3%		2.9%		3.7%		3.3%		3.1%

Source: FAA Form 5010, Airport Records and PBS&J, 2009.

Table 3-11. Forecast of Total Operations

Year	Based Aircraft	Total Operations	OPBA
Historical			
1985	93	43,400	251
1986	173	43,400	241
1987	169	60,000	306
1988	196	61,303	302
1989	203	60,000	293
1990	205	60,000	287
1991	181	60,000	279
1992	170	60,000	274
1993	170	65,000	294
1994	171	65,000	289
1995	216	65,000	286
1996	216	65,000	285
1997	216	65,000	284
1998	216	65,000	283
1999	216	65,000	277
2000	216	65,000	270
2001	231	65,000	263
2002	258	64,000	257
2003	261	65,000	260
2004	262	65,000	255
2005	262	64,000	248
2006	264	64,000	245
Forecast			
2010	318	86,813	273
2015	356	97,267	273
2020	404	110,317	273
2025	464	126,650	273
2030	539	147,178	273
Average Annual Growth Rates			
1985-2006	2.0%	1.9%	
2006-2030	3.1%	3.5%	

Sources: FAA Terminal Area Forecast, PBS&J, 2009.

3.8.2 Forecast of Itinerant and Local Operations

General aviation operations are classified as either local or itinerant. Local operations involve a take-off or landing performed by an aircraft that operates within sight of the airport or which executes simulated approaches or touch-an-go operations at the airport. Itinerant operations are those performed by aircraft with a specific origin or destination away from the airport. As shown in **Table 3-12**, the percentage of operations at RTS performed by itinerant aircraft has held constant at a range between 46.2 and 45.3 percent. For the purposes of this analysis, the 2006 percentage distribution of itinerant and local share of the total operations was held constant into the future at 45.3 percent and 54.7 percent, respectively.

Table 3-12. Forecast of Itinerant and Local Operations

Year	Itinerant Operations	Itinerant Share	Local Operations	Local Share	Total Operations
Historical					
1985	18,400	42.4%	25,000	57.6%	43,400
1986	18,400	42.4%	25,000	57.6%	43,400
1987	25,000	41.7%	35,000	58.3%	60,000
1988	25,336	41.3%	35,967	58.7%	61,303
1989	25,000	41.7%	35,000	58.3%	60,000
1990	25,000	41.7%	35,000	58.3%	60,000
1991	25,000	41.7%	35,000	58.3%	60,000
1992	25,000	41.7%	35,000	58.3%	60,000
1993	30,000	46.2%	35,000	53.8%	65,000
1994	30,000	46.2%	35,000	53.8%	65,000
1995	30,000	46.2%	35,000	53.8%	65,000
1996	30,000	46.2%	35,000	53.8%	65,000
1997	30,000	46.2%	35,000	53.8%	65,000
1998	30,000	46.2%	35,000	53.8%	65,000
1999	30,000	46.2%	35,000	53.8%	65,000
2000	30,000	46.2%	35,000	53.8%	65,000
2001	30,000	46.2%	35,000	53.8%	65,000
2002	29,000	45.3%	35,000	54.7%	64,000
2003	30,000	46.2%	35,000	53.8%	65,000
2004	30,000	46.2%	35,000	53.8%	65,000
2005	29,000	45.3%	35,000	54.7%	64,000
2006	29,000	45.3%	35,000	54.7%	64,000
Forecast					
2010	39,326	45.3%	47,487	54.7%	86,813
2015	44,062	45.3%	53,205	54.7%	97,267
2020	49,974	45.3%	60,343	54.7%	110,317
2025	57,372	45.3%	69,278	54.7%	126,650
2030	66,672	45.3%	80,506	54.7%	147,178
Average Annual Growth Rate					
1985-2006	2.2%		1.6%		1.9%
2006-2030	3.5%		3.5%		3.5%

Sources: FAA Terminal Area Forecast, PBS&J, 2009.

3.8.3 Forecast of Military Operations

Military operations are also an important factor in air traffic activity at RTS. The Army Aviation Support Facility of the Nevada Army Air Guard is based at RTS. Currently, the Nevada Army Air Guard has 14 helicopters and one fixed wing aircraft based at RTS. Historical and forecasted military operations identified in the FAA Terminal Area Forecasts show a constant 10,000 operations per year for military. *The Master Plan for the Nevada Army National Guard* was completed in September of 2002 and as part of the proposed facility expansion, there was a projection of based military aircraft from 2002 to 2020.

In projected future military operations, an OPBA methodology was also applied. With 10,000 operations and 15 based aircraft, the military yields 667 OPBA. **Table 3-13** provides the military operations forecast through the planning period. As shown, military operations are projected to increase from 10,000 in 2006 to approximately 21,300 by 2030, an average annual growth rate of 3.2 percent.

Table 3-13. Forecast of Military Operations

Year	Based Aircraft	Operations	OPBA
Historical			
2006	15	10,000	667
Forecast			
2010	18	12,006	667
2015	20	13,340	667
2020	24	16,008	667
2025	28	18,676	667
2030	32	21,344	667
Average Annual Growth Rate			
2006-2030		3.2%	

Sources: Master Plan for Nevada Army National Guard, September 30, 2002 and PBS&J, 2009.

3.9 ALTERNATIVE FORECASTS

To ensure that the forecasting process reasonably reflects likely activity levels at RTS in the future, the assumptions behind the preferred forecast were tested and an alternative forecast was prepared. Since RTS has a stable community of aviation users with no long-term constraint challenges or commercial operations, the only assumption that could affect the forecast is the discontinuation of the National Championship Air Races and Air Show held at RTS.

The 2006 acoustical traffic counter data was examined for operations that appeared to be specifically related to the National Championship Air Races and Air Show. In 2006 the National Championship Air Races and Air Show was held September 13-17, with activity at RTS showing a spike from September 10 through September 18. There is also a training and qualifications period in June (Pylon Racing School), which was identified as being June 16 through June 18 in 2006. It was found that, excluding the National Championship Air Races and Air Show periods (June 16-18, September 10-18), RTS averages 68 operations a day. During the National Championship Air Races and Air Show periods that average rises to 373 operations a day. Although RTS is closed to all other traffic during the event, it is assumed that if the National Championship Air Races

and Air Show were not held, RTS would still have the annual average of 68 operations for each of the twelve days that make up the National Championship Air Races and Air Show periods. This alternative forecast subtracts out the operations that are above and beyond (incremental to) the daily average. As a result, there were a total of approximately 3,660 additional operations during the National Championship Air Races and Air Show periods. These operations that are identified as being additional and attributable to the National Championship Air Races and Air Show account for 5.72 percent of the total 2006 annual operations at RTS.

It is assumed that military and helicopter operations do not change based on the National Championship Air Races and Air Show. Therefore, in order to forecast the reduction in operations that would occur if the National Championship Air Races and Air Show were discontinued, all operations other than military and helicopter were reduced by 7.0 percent, which yields a total operations reduction of 5.72 percent. These reductions were applied to each of the forecast years. The reduced forecast is shown with the preferred forecast and the difference between the two on **Table 3-14**. Given this minor difference, no significant impact for facilities planning is expected from continuation or discontinuation of the National Championship Air Races and Air Show.

Table 3-14. Alternative Forecast of Total Annual Aircraft Operations

	Year	Itinerant	Local	Total
Operations	**Actual**			
	2006	29,000	35,000	64,000
	Forecast			
	2010	39,326	47,487	86,813
	2015	44,062	53,205	97,267
	2020	49,974	60,343	110,317
	2025	57,372	69,278	126,650
	2030	66,672	80,506	147,178
Without National Championship Air Races and Air Show	2010	37,077	44,770	81,847
	2015	41,542	50,162	91,703
	2020	47,115	56,892	104,007
	2025	54,091	65,315	119,406
	2030	62,858	75,901	138,759
Difference	2010	(2,249)	(2,716)	(4,966)
	2015	(2,520)	(3,043)	(5,564)
	2020	(2,858)	(3,452)	(6,310)
	2025	(3,282)	(3,963)	(7,244)
	2030	(3,814)	(4,605)	(8,419)

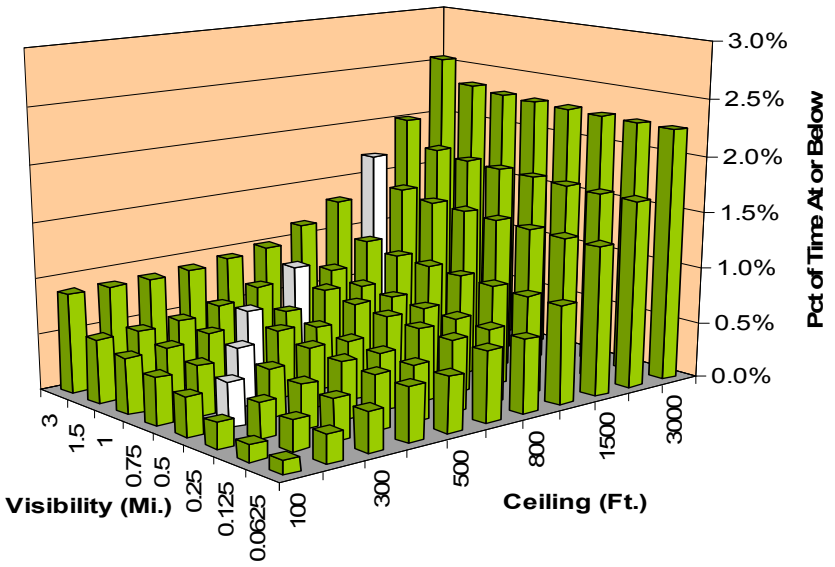
Source: PBS&J, 2009.

3.10 FORECAST OF INSTRUMENT OPERATIONS

As described in Chapter 2, an Instrument Landing System (ILS) has been installed on Runway 14-32 and was certified and operational starting in July 2009. In order to develop a forecast of the expected ILS operations at RTS now that the system is online, two factors were considered. The first factor was the number of ILS operations based on weather related events where weather conditions necessitated the use of the ILS. To calculate this portion of ILS operations demand, the FAA's Benefit-Cost Analysis model was referenced. This model is used in the funding approval process and includes historical weather data specific to each airport and standard assumptions on visibility and ceiling minima; this allows the model to calculate expected ILS usage at an airport. The second factor in the development of the forecast of ILS operations is the number of training operations that will likely use ILS facilities. The calculation of this portion of the ILS operations forecast was adapted from the ILS Environmental Assessment (ILS EA) which was recently completed.

Figure 3-6 shows the model's calculation of extrapolated weather distribution for RTS. This extrapolation shows that weather conditions would require use of the ILS for approximately 2.25 percent of the time. Without any other contradictory data, it was determined that it would be reasonable to expect 2.25 percent of forecasted operations to operate using the ILS. This forecast of weather related ILS operations is presented on **Table 3-15.**

Figure 3-6. Extrapolated Weather Distribution for Reno-Stead



Source: FAA's Instrument Landing System Cost-Benefit Model.

In addition to the weather related ILS operations, approximately 8.0 percent of total operations are expected to use the ILS system for training purposes. The ILS EA had estimated 10.0 of the total operations would utilize the ILS system, and this report calculated 2.25 percent of total operations as ILS weather related and approximately 8.0 percent of total operations as ILS training related operations. The ILS training operations and total ILS operations are shown in **Table 3-15**.

Table 3-15. Forecast of Total ILS Operations

Year	Total Operations	ILS Weather Related Operations	ILS Training Operations	Total ILS Operations
Historical				
2006	64,000			
Forecast				
2010	86,813	1,953	6,945	8,898
2015	97,267	2,189	7,781	9,970
2020	110,317	2,482	8,825	11,307
2025	126,650	2,850	10,132	12,982
2030	147,178	3,312	11,774	15,086

Notes: ILS system came online July 2009.
Sources: Final Environmental Assessment for Instrument Landing System and Approach Lighting System for Runway 32 at Reno-Stead Airport, December 2005 and PBS&J, 2009.

3.11 FORECAST OF PEAK OPERATIONS – MONTH, DAY AND YEAR

Many of the facility planning requirement calculations that will be presented in subsequent chapters are based on accommodating peak periods of activity. Peaking characteristics are usually defined as peak month, average day of the peak month, and peak hour activity.

The FAA defines the theoretical "peak-hour operations" as the total number of aircraft operations expected to occur at an airport, averaged for two adjacent peak hours of a typical peak time. Peaking characteristics are determined from peak monthly activity, average daily activity within the peak month and then estimating the peak hourly activity within the Average Day Peak Month (ADPM).

The first step in this process is to identify RTS's peak month. Actual historical data is unavailable, however, based on conversations with airport staff and tenants, the summer months of June, July and August are identified as the busiest months. Experience at other general aviation airports without air traffic control towers has shown that approximately 12 percent of total annual operations occur during the peak month. This factor was applied to estimate the peak month total operations at RTS. As shown on **Table 3-16**, approximately 9,600 operations likely occurred during RTS's peak month in 2006. By 2030 the peak month operations are expected to total approximately 22,077.

As the number of days in a month varies throughout the year, typically 30.42 is used to represent the average number of days in a month. The peak month operations are divided by the average number of days in a month in order to calculate an airport's ADPM, as represented by the following equation: Average Day = (Peak month/ 30.42 days). RTS's ADPM operations were approximately 316 in 2006 and are expected to increase to 726 in 2030.

The peak hour is the busiest hour during the average day of the peak month. Typically between 10 and 20 percent of the daily activity occurs during the peak hour at general aviation airports. This report uses 15 percent of the ADPM for the peak hour. As shown on Table 3-16, the peak hour operations in 2006 were 47 and are expected to increase to 109 by 2030.

It is important to remember that these calculations are for planning purposes only and represent totals used in FAA approved planning procedures. It is acceptable and probably likely that the peak hour, day, and month calculations do not exactly match actual conditions.

Table 3-16. Forecast of Peak Operations

Year	Total Operations	Peak Month Operations	Average Day Operations	Peak Hour Operations
Historical				
2006	64,000	9,600	316	47
Forecast				
2010	86,813	13,022	428	64
2015	97,267	14,590	480	72
2020	110,317	16,548	544	82
2025	126,650	18,998	625	94
2030	147,178	22,077	726	109

Source: PBS&J, 2009.

3.12 FORECAST OF FUEL FLOWAGE

An additional consideration in facility requirements planning is preparation of projected fuel flowage demand, measured in gallons, which is used to size the facilities necessary to meet that demand. Current fuel flowage estimates come from RTS records and are divided into two classes of fuel: Jet-A and 100 Low Lead (LL).

Estimates of fuel flowage were developed by taking the 2006 fuel flowage for Jet-A and 100LL and multiplying them by the growth rates for jet aircraft and non-jet aircraft respectively. This is an estimate of the level of fuel flowage and obviously depends on factors such as whether fuel is purchased locally or at other locations, increasing/decreasing fuel efficiency, greater/lesser intensity of aircraft use, average length of trip, etc. The fuel flowage forecast is shown in **Table 3-17**.

3.13 FORECAST SUMMARY

Table 3-18 presents the forecast summary for RTS using the forecasts of aviation activity developed in this chapter. These forecasts will be used in later sections to develop the demand/capacity analysis and facility requirements for RTS out to 2030.

Table 3-17. Forecast of Fuel Flowage (in Gallons)

Year	Jet Operations	Jet-A Fuel (gal)	Jet-A per operation (gal)	Non-Jet Operations	100LL Fuel (gal)	100LL per operation (gal)
Historical						
2006	4,672	190,638	40	59,328	157,401	3
Forecast						
2010	7,379	295,160	40	79,434	238,302	3
2015	8,851	354,040	40	88,416	265,248	3
2020	10,258	410,320	40	100,058	300,174	3
2025	11,905	476,200	40	114,745	344,235	3
2030	14,129	565,160	40	133,049	399,147	3

Source: Aviation Classics, LTD and PBS&J, 2009.

Table 3-18. Summary of Forecast Activity

	Base Year	Forecasts				
	2006	2010	2015	2020	2025	2030
Based Aircraft						
Single-Engine Piston	175	216	243	277	322	376
Multi-Engine Piston	23	23	23	23	22	22
Military	15	18	20	24	28	32
Turboprop	2	2	3	3	4	4
Jet	19	25	28	33	37	45
Helicopter	27	34	38	44	51	59
Total	261	318	356	404	464	539
Aircraft Operations						
Local Operations	35,000	47,487	53,205	60,343	69,278	80,506
Itinerant	29,000	39,326	44,062	49,974	57,372	66,672
Total	64,000	86,813	97,267	110,317	126,650	147,178
ILS Operations						
Weather Related	see note	1,953	2,189	2,482	2,850	3,312
Training Related	see note	6,945	7,781	8,825	10,132	11,774
Total		8,898	9,970	11,307	12,982	15,086
Peak Level Operations						
ADPM	316	428	480	544	625	726
ADPM Peak Hour	47	64	72	82	94	109
Annual Fuel Flowage (gallons)						
Jet A	190,638	295,160	354,040	410,320	476,200	565,160
100LL	157,401	238,302	265,248	300,174	344,235	399,147
Total	348,039	533,462	619,288	710,494	820,435	964,307

Note: ILS online July 2008.
Source: PBS&J, 2009.

DEMAND/CAPACITY ANALYSIS AND FACILITY REQUIREMENTS

4

Reno-Stead Airport

4.1 GENERAL

Based on the aviation forecasts developed in Chapter 3, this chapter compares the projected aviation demand to the capacity of the existing facilities at Reno-Stead Airport (RTS). This comparison is then used to determine future facility requirements needed over the 20-year planning period. The facility improvements are directly related to the forecasted aviation activity and will allow RTS and the surrounding community to be adequately prepared to accommodate the potential demand over the 20-year planning period.

4.2 AIRSPACE CAPACITY

Airspace capacity at an airport is of concern when the flight paths of traffic at nearby airports or local navigational aids (NAVAIDS) interact to adversely impact operations at the airport of study. Also of concern is the need to alter flight paths in order to avoid obstructions during aircraft approaches.

A single commercial service airport is located in close proximity to RTS. Reno-Tahoe International Airport (RNO) is located approximately 11 miles south east of RTS, and RTS lies just outside of RNO's Class C airspace. RTS and RNO are far enough from each other that air traffic is normally able to maintain adequate separation; however, the precision approach surfaces associated with RTS's Runway 32 and RNO's Runway 16R do intersect as can be seen in **Figure 4-1**.

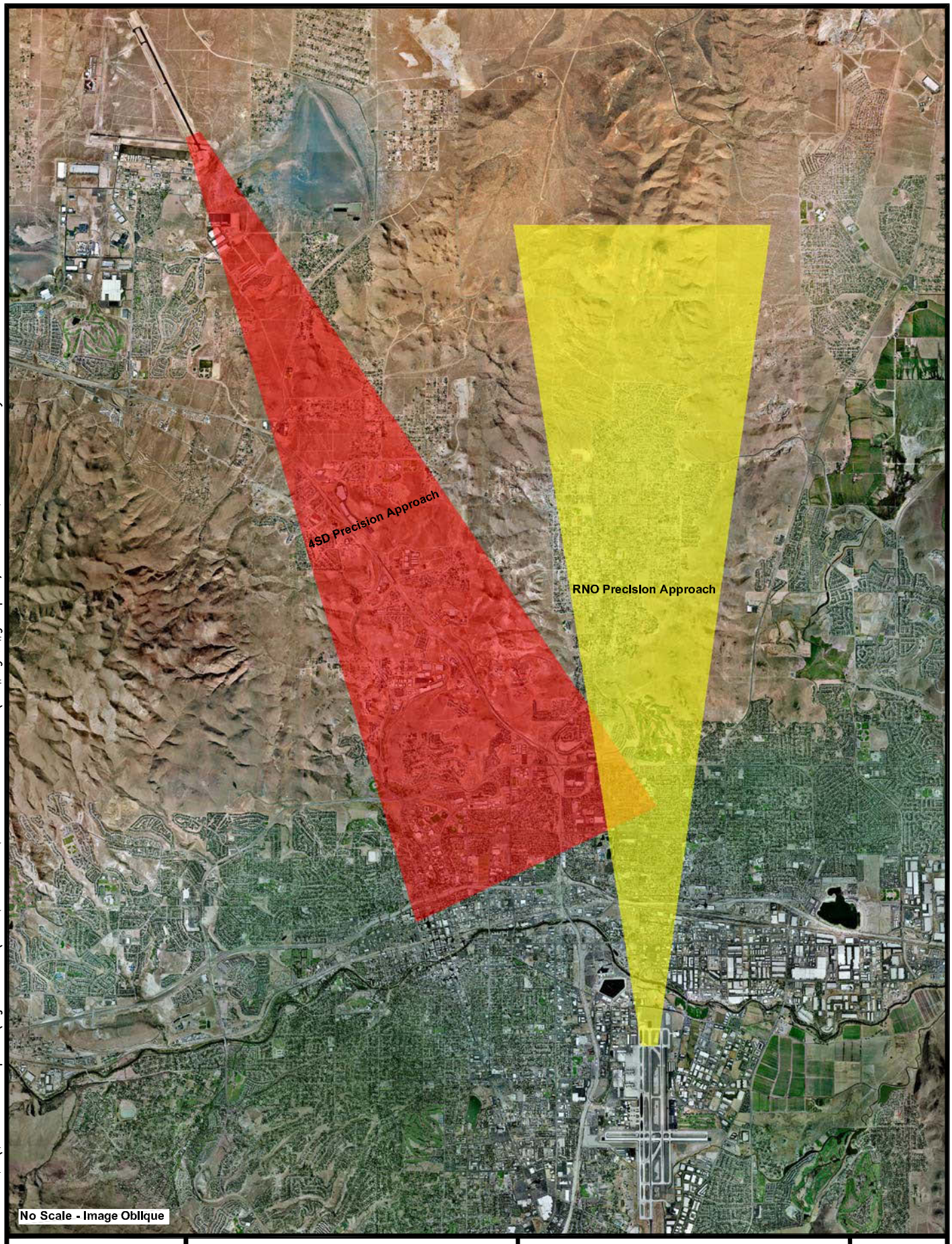
Several general aviation (GA) private- and public-use airports lie within a 50 nautical mile radius of RTS. These airports, as well as RNO, are listed in **Table 4-1**. More specific information on these airports can be found in Chapter 2 of this document.

No controlled and/or restricted military airspace is located within the immediate vicinity of RTS. The closest Military Operation Area (MOA) and restricted area can be found roughly 65 miles east southeast of RTS; both of which are associated with the Fallon Naval Air Station.

Overall, the airspace surrounding RTS is not congested by military and/or special use airspace, and GA airports in the surrounding airspace are far enough from RTS so as to not negatively impact operations.

4.3 AIRSIDE CAPACITY AND FACILITY REQUIREMENTS

The major components to be considered when determining capacity include runway orientation and configuration, runway length, and runway exit locations. Additionally, the capacity of any given airfield system is affected by operational characteristics such as fleet mix, climatology, and Air Traffic Control (ATC) procedures. Each of these components has been examined as part of the airfield capacity analysis.



PBS&J	Reno Stead Airport Master Plan Update Reno-Stead Reno, Nevada	Precision Approach Overlaps Between RTS and RNO	Figure 4-1

J:\AVServ\071889.00 Reno MP\Master Plan Update\Figure-PDFs\ILS INTERSECTION 4SD and RenoTahoe\Drawing1.dwg Apr07,2010 - 10:38am Plotted By: 23208

Table 4-1. Private- and Public-Use Airports in the Region

Airport Name	Distance From RTS in Nautical Miles
Commercial Service	
Reno-Tahoe International Airport (RNO)	11
General Aviation – Private-Use	
H Bar H	5
Justover Field	12
Palomino	13
Rolling Thunder	14
Air Sailing Gliderport	17
Bailey Ranch	22
Totem Pole	25
General Aviation – Public-Use	
Spanish Springs Airport (N86)	7
Sierraville-Dearwater Airport (O79)	22
Nervino Airport (O02)	24
Truckee-Tahoe Airport (TRK)	24
Carson City Airport (CXP)	29
Parker Carson STOLport (2Q5)	29
Dayton Valley Airpark (A34)	30
Tiger Field (N58)	30
Silver Springs Airport (SPZ)	33
Minden-Tahoe Airport (MEV)	40
Lake-Tahoe Airport (TVL)	47

Source: San Francisco Sectional Aeronautical Chart 2006.

4.3.1 Airfield Capacity

A demand and capacity analysis of airfield systems and facilities, such as RTS's runways and taxiways, results in separate calculated hourly capacities for Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) conditions. Additionally, an annual service volume (ASV), which identifies the total annual number of aircraft operations that may be accommodated at the airport without excessive delay, is also calculated. The FAA defines total airport capacity as a reasonable estimate of the airport's annual capacity, which accounts for runway use, aircraft mix, weather conditions, etc. that would be encountered over a year's time. The parameters, assumptions, and calculations required for this analysis are included in the following sections.

4.3.1.1 Airfield Parameters and Assumptions

Runway Orientation, Utilization, and Wind Coverage

RTS has two runways (Runway 8-26 and Runway 14-32) that were evaluated to determine the overall capacity of the airfield, which is defined as the sum of capacities determined for each aircraft operation (takeoff and landing). Each operation is defined by its direction which is often influenced by wind direction and speed, available instrument approaches, airspace restrictions, and/or other operating parameters. The runway use configurations used for RTS capacity calculations considered Runways 8, 14, 26, and 32 in VFR conditions. Operations in IFR conditions were evaluated for only Runway 32, since it is the only runway with a published instrument approach.

The overall runway use was determined through a review of the recent *Runway Safety Area (RSA) Compliance Study* completed by URS Corporation in October 2008, and verified through discussion with Reno-Tahoe Airport Authority (RTAA). **Table 4-2** shows the runway utilization at RTS as presented in the RSA Study.

Table 4-2. Estimated Runway Utilization

Runway	Percent of Time
8	7.1%
26	77.2%
14	3.1%
32	12.6%
Total	100.0%

Source: Reno-Stead Airport RSA Standards Compliance Study, Final Report, October 2008, URS.

The single most important criterion for runway orientation is wind coverage. Runways should be provided at an airport to maximize the opportunity for aircraft to takeoff and land heading into the wind. When a runway orientation provides less than 95 percent wind coverage for any aircraft using the airport on a regular basis, a crosswind runway is required by the Federal Aviation Administration (FAA). According to FAA Advisory Circular (AC) 150/5300-13, *Airport Design*, the 95 percent wind coverage is computed on the basis of the crosswind not exceeding 10.5 knots and 13 knots for smaller aircraft and 16 knots and 20 knots for larger aircraft. As previously shown in Figure 2-5, Runways 8-26 and 14-32 do not individually meet the 10.5 knot crosswind coverage for the smaller aircraft. It is only with the combined wind coverage of both runways that adequate wind coverage is provided with 96.13 percent for a 10.5 knot crosswind, 97.63 percent for a 13 knot crosswind, and 98.89 percent for a 16 knot crosswind.

Aircraft Mix Index

The FAA has developed a classification system for grouping aircraft, based on size, weight, and performance. **Table 4-3**, FAA Aircraft Classifications, illustrates the classification categories as they are presented in FAA AC 150/5060-5, *Airport Capacity and Delay*. This classification system is used to develop an aircraft mix which is the relative percentage of operations conducted by each of the four classes of aircraft (A, B, C, and D). The aircraft mix is used to calculate a mix index which is then used for airfield capacity studies. The FAA defines the mix index as a mathematical expression, representing the percent of Class C aircraft, plus three times the percent of Class D

aircraft (C+3D). The FAA has established mix index ranges for use in capacity calculations as listed below:

- 0 to 20
- 21 to 50
- 51 to 80
- 51 to 120
- 121 to 180

A review of the aviation demand forecast from the previous chapter shows that the likelihood of RTS growing beyond the first mix index range of 0 to 20 during the 20-year planning period is very low. This assumption is also supported by the previous RTS master plan forecast and mix index calculations. As a result, this capacity analysis has assumed that the mix index for the entire 20-year planning period will be in the first mix index range of 0-20, represented in **Table 4-4**.

Table 4-3. FAA Aircraft Classifications

Aircraft Class	Max. Cert. Takeoff Weight (lb)	Number of Engines	Wake Turbulence Classification
A	12,500 or less	Single	Small (S)
B	12,501 – 41,000	Multi	Small (S)
C	41,000 – 300,000	Multi	Large (L)
D	Over 300,000	Multi	Heavy (H)

Source: FAA AC 150/5060-5, Airport Capacity and Delay.

Table 4-4. Aircraft Mix Index Projection

Year	Total Annual Operations	Aircraft Mix Index
Base Year		
2006	64,077	0-20 %
Forecast		
2010	76,764	0-20 %
2015	82,484	0-20 %
2020	91,407	0-20 %
2025	101,843	0-20 %
2030	113,288	0-20 %

Source: FAA AC 150/5060-5, Airport Capacity and Delay and PBS&J, 2008.

Arrivals Percentage

The percentage of arrivals is the ratio of arrivals to total operations. It is typically safe to assume that the total annual arrivals will equal total departures and that average daily arrivals will equal average daily departures. Additionally, based on information obtained from the Fixed Base Operator (FBO) and RTAA records, the percentage of arrivals for RTS was estimated to be approximately 50 percent. Therefore, a factor of 50 percent arrivals was used in the capacity calculations for RTS.

Touch-and-Go Percentage

The touch-and-go percentage is the ratio of landings with an immediate takeoff to total operations. This type of operation is typically associated with flight training. The number of touch-and-go operations normally decreases as the number of total operations

approach runway capacity and/or weather conditions deteriorate. Typically, touch-and-go operations are assumed to be between zero and 50 percent of total operations.

Based on information obtained from the RTAA and FBO, approximately 50 percent of all local GA operations are touch-and-go operations. Thus, it is estimated that touch-and-go operations account for approximately 30 percent of total operations at RTS. Based on this information, touch-and-go factors of 1.0 for VFR operations and 1.0 for IFR operations were selected as required by the guidelines presented in the FAA AC 150/5060-5, *Airport Capacity and Delay*. These factors will be used later in the hourly runway capacity and ASV calculations.

Taxiway Factors

Taxiway entrance and exit locations are an important factor in determining the capacity of an airport's runway system. Runway capacities are highest when there are full-length, parallel taxiways, ample runway entrance and exit taxiways, and no active runway crossings. All of these components reduce the amount of time an aircraft remains on the runway. FAA AC 150/5060-5, *Airport Capacity and Delay* identifies the criteria for determining taxiway exit factors at an airport. The criteria for exit factors are generally based on the mix index and the distance the taxiway exits are from the runway threshold and other taxiway connections. Because the mix index for RTS was calculated to be in the lower range of 0-20 throughout the 20-year planning period, only exit taxiways that are between 2,000 and 4,000 feet from the threshold and spaced at least 750 feet apart contribute to the taxiway exit factor. Taxiways that met these parameters were considered in completing the capacity calculations for all directions and for all conditions.

Taxiway exits were evaluated for operations in all directions on both Runway 8-26 and Runway 14-32. Both runways have a full parallel taxiway, and four taxiway exits were identified that meet the previously mentioned criteria. This results in a taxiway exit factor of 1.0 for VFR operations and 1.0 for IFR operations.

Instrument Approach Capability

Instrument approach capability is qualified based upon the ability of the airport to safely accommodate aircraft operations during periods of inclement weather. Weather, in this regard, is characterized by two measures, local visibility in statute miles and height of a substantial cloud ceiling above airport elevation. These two measures are termed minimums. The Instrument Landing System (ILS) Approach to Runway 32 provides this capability by enabling a precision approach.

Weather Influences

Weather data obtained from the Western Region Climatic Center identified that IFR conditions (ceilings less than 1,000 feet above ground level [AGL] and/or visibility less than 3 miles) occur significantly less than two percent of the time at RTS. Being that RTS is in VFR conditions more than 90 percent of the time, RTS will be treated as a VFR airport for capacity purposes.

4.3.1.2 Airfield Capacity Calculations

The airfield capacity calculations in this section were performed using the parameters and assumptions discussed in the previous sections. The calculations also utilize data from the preferred aviation demand forecast, as presented in Chapter 3, for portions of the capacity projections. The following sections outline the hourly capacities in VFR and IFR conditions, as well as the annual service volume for RTS.

Hourly VFR Capacity

The hourly VFR capacity for RTS was calculated based on the guidance and procedures in FAA AC 150/5060-5, *Airport Capacity and Delay*. Hourly VFR capacity was calculated to be 180 operations per hour. The following equation and calculations present the step-by-step method that was utilized to calculate the hourly VFR capacity.

Hourly VFR Equation

Hourly Capacity Base (C*) x Touch-and-Go Factor (T) x Exit Factor (E) = Hourly Capacity

C* x T x E = Hourly Capacity

180 x 1.0 x 1.0 = 180

The VFR hourly capacity will be used in the annual service volume calculations for RTS.

Hourly IFR Capacity

Similar to the VFR hourly capacity discussed previously, IFR hourly capacity was calculated for RTS. Since visibility is reduced during IFR conditions, substantially more spacing is required between aircraft resulting in a lower hourly capacity. The hourly IFR capacity was calculated to be 60 operations per hour. As referenced in Section 4.2 Airspace Capacity, RTS lies just outside of RNO's Class C airspace. Although the precision approach surfaces for both airports intersect, the hourly IFR capacity at RTS is not affected. The hourly IFR capacity equation and calculations are shown below.

Hourly IFR Equation

Hourly Capacity Base (C*) x Touch-and-Go Factor (T) x Exit Factor (E) = Hourly Capacity

C* x T x E = Hourly Capacity

60 x 1.0 x 1.0 = 60

Annual Service Volume

The ASV is the maximum number of annual operations that can occur at an airport before an assumed reasonable operational delay value is encountered. The ASV is calculated based on the existing runway configuration, aircraft mix, and the parameters and assumptions identified herein and incorporates the hourly VFR and IFR capacities calculated previously. Utilizing this information and the guidance provided in FAA AC 150/5060-5, *Airport Capacity and Delay* the ASV for existing conditions at RTS was calculated to be 299,702 operations. It should be noted that the ASV represents the existing airfield capacity in its present configuration, with one north-south runway, one east-west runway, two full-length parallel taxiway and ILS and GPS approach capabilities on Runway 32. The equation and calculations used to obtain the ASV were taken from the FAA AC 150/5060-5, and are presented below.

ASV Equation

Weighted Hourly Capacity (Cw) x Annual/Daily Demand (D) x Daily/Hourly Demand (H) = Annual Service Volume (ASV)

ASV Calculation

Cw x D x H = ASV

177.6 x 253 x 6.67 = 299,702

The current aviation demand in number of aircraft operations for the base year 2006 at RTS, as presented in Chapter 3 of this document, is 64,000 operations. This equals approximately 21.4 percent of the present ASV. According to the FAA, the following guidelines should be used to determine necessary steps as demand reaches designated levels of airfield capacity:

- 60 percent of ASV: threshold at which planning for capacity improvements should begin;
- 80 percent of ASV: threshold at which planning for improvements should be complete and construction should begin; and
- 100 percent of ASV: threshold at which the total number of annual operations (demand) that can be accommodated has been reached and capacity-enhancing improvements should be made to avoid extensive delays.

Table 4-5 illustrates the RTS's preferred aviation demand forecast and its relation to the airfield ASV.

Table 4-5. Annual Service Volume vs. Annual Demand

Year	Aircraft Mix Index	Annual Operations	Annual Service Volume	Percent of Annual Service Volume
Base Year				
2006	0-20 %	64,077	299,702	21.4%
Forecast				
2010	0-20 %	76,764	299,702	25.6%
2015	0-20 %	82,484	299,702	27.5%
2020	0-20 %	91,407	299,702	30.5%
2025	0-20 %	101,843	299,702	34.0%
2030	0-20 %	113,288	299,702	37.8%

Source: FAA AC 150/5060-5, Airport Capacity and Delay and PBS&J, 2008.

Given the current and forecasted annual operations as well as the calculated ASV for RTS, no improvements need to take place to mitigate any capacity issues foreseen over the 20-year planning period.

4.3.2 Runway and Taxiway System Design Requirements

An initial step in identifying an airport's potential runway and taxiway facility requirements is the establishment of fundamental development guidelines for the largest or most critical aircraft expected to use the facility. FAA guidance on dimensional standards is based on the Airport Reference Code (ARC) system. The ARC is defined using an alphanumeric designation, or letter designation followed by a Roman numeral. The letter designator is used to identify the Aircraft Approach Category (AAC) based on aircraft approach speeds and the Roman numeral designates the Airplane Design Group (ADG) based on wingspan. **Table 4-6** depicts the criteria used to define the ARC according to FAA Advisory Circular 150/5300-13, *Airport Design*.

Table 4-6. Airport Reference Code Breakdown

Aircraft Approach Category	
Category	**Approach Speed (knots)**
A	<91
B	91-121
C	121-141
D	141-166
E	>166
Airplane Design Group	
Design Group	**Wingspan (feet)**
I	<49
II	49-78
III	79-117
IV	118-170
V	171-213
VI	214-262

Source: FAA AC 150/5060-5, Airport Capacity and Delay and PBS&J, 2008.

RTS has been classified as an ARC C-III airport; and the Boeing 737-900 identified as the critical design aircraft. The critical design aircraft affects key aspects of airport design, such as sizing of runways, taxiways/taxilanes, aircraft parking areas, and hangar facilities. The critical design aircraft is traditionally the most physically demanding aircraft based at, or using the airport and having more than 500 itinerant operations annually. The aviation demand forecast clearly establishes that RTS is expected to experience more than 500 operations by C-III aircraft annually. For purposes of this report, aircraft requiring C-III design standards and weighing more than 12,500 pounds will be considered the current critical or design aircraft. The design aircraft controls design standards such as runway width, pavement strength, and runway and taxiway separations criteria.

Throughout the 20-year planning period, it is anticipated that aircraft requiring C-III design standards will frequent RTS in sufficient numbers to maintain the classification. It is therefore reasonable to maintain the current airfield facilities and plan future facilities to accommodate this level of service. Not all areas of the airfield require construction based upon these more stringent design standards. Areas of the RTS facility which are intended solely for smaller Group A and/or B aircraft, such as hangar areas and the taxilanes which serve them, should be designed for that type of aircraft.

4.3.2.1 Runway 8-26

Based on prevailing wind direction and aircraft utilization, Runway 8-26 is the most frequently used runway and has a length of 7,608 feet and a width of 150 feet which meets the standards established in FAA Advisory Circular 150/5300-13, *Airport Design,* for an airport with an ARC of C-III and a design aircraft weighing more than 60,000 pounds. Runway 8-26 pavement is currently in good condition; however, rehabilitation will be warranted within the planning period even with timely preventative maintenance. The C-III designation for Runway 8-26 also requires standard lengths and widths for the associated runway protective surfaces, including the Runway Safety Area (RSA), the Runway Object Free Area (OFA), the Obstacle Free Zone (OFZ), and the Runway Protection Zones (RPZ). Each one of these protective surfaces is depicted in detail on the Airport Layout Plan (ALP) presented in Chapter 7. Runway 8-26 is currently

compliant with all of the ARC C-III protective surfaces except for the RSA criteria. Specifically, the RSA at the approach end of Runway 26 does not meet proper grading requirements. Furthermore, vegetation and unevenness in terrain yield the RSA non-compliant with standards near the west end of Runway 8-26. The *Reno-Stead Airport RSA Standards Compliance Study Final Report, October 2008* prepared by URS Corporation recommended the construction of a 575-foot extension to Runway 8 and applying declared distances. The displacement of 575 feet on both runway ends would have ensured the proper 1,000 feet of cleared and graded area beyond the runway threshold to allow for the occasional passage of aircraft without causing structural damage to the aircraft.

As the design for the RSA construction project reached 60 percent completion, current cost estimates (Reynolds, Smith & Hills, Inc., January 2010) for the recommended 575-foot extension neared $3 million. RTAA staff reconsidered the previously discounted alternatives and determined that applying declared distances and displacing the Runway 26 threshold by 314 feet would provide a better financial and operational solution. Declared distances are defined as follows:

- Takeoff Run Available (TORA) – the runway length declared available and suitable for the ground run of an aircraft taking off.
- Takeoff Distance Available (TODA) – the TORA plus the length of any remaining runway or clearway beyond the far end of the TORA.
- Accelerate Stop Distance Available (ASDA) – the runway plus stopway length declared available and suitable for the acceleration and deceleration of an aircraft aborting takeoff.
- Landing Distance Available (LDA) – the runway length declared available and suitable for an aircraft to land.

The declared distances are listed in **Table 4-7**.

Table 4-7. Declared Distances for Runway 8-26

Declared Distance	Runway 8	Runway 26
TORA	6,956	7,608
TODA	6,956	7,608
ASDA	6,956	7,608
LDA	6,956	7,294

Sources: FAA AC 150/5300-13, Airport Design, Reno-Stead Airport RSA Standards Compliance Study, Final Report, October 2008, URS and PBS&J, 2009.

The improvements described above are currently being implemented to bring the Runway 8-26 RSA into compliance with the FAA standards. The RSA improvements will be completed by the end of calendar year 2010.

4.3.2.2 Runway 14-32

Runway 14-32 is 9,000 feet long and 150 feet wide. Runway 14-32 is the lesser used of the two runways at RTS but is critical to the overall capability of the airfield and also meets ARC C-III standards. Runway 14-32 is also currently compliant with all of the ARC C-III protective surfaces except for the RSA criteria. The *Reno-Stead Airport RSA Standards Compliance Study Final Report, October 2008* prepared by URS Corporation recommended moving the end of Runway 32 by 320 feet to the northwest and applying declared distances. The declared distances are listed in **Table 4-8**.

Table 4-8. Declared Distances for Runway 14-32

Declared Distance	Runway 14	Runway 32
TORA	8,680	9,000
TODA	8,680	9,000
ASDA	8,680	9,000
LDA	8,680	7,800

Sources: FAA AC 150/5300-13, Airport Design, Reno-Stead Airport RSA Standards Compliance Study, Final Report, October 2008, URS and PBS&J, 2009.

The improvements described above are currently being implemented to bring the Runway 14-32 RSA into compliance with the FAA standards. The RSA improvements will be completed by the end of calendar year 2010.

4.3.2.3 Runway Designations

A runway designation is identified by the whole number nearest the magnetic azimuth of the runway when oriented along the runway centerline as if on an approach to that runway end. This number is then rounded off to the nearest unit of ten. Magnetic azimuth is determined by adjusting the geodetic azimuth associated with a runway to compensate for magnetic declination. Magnetic declination is defined as the difference between true north and magnetic north. This value of magnetic declination varies over time and is dependent on global location. Change in magnetic declination is a natural process and does periodically require re-designation of runways.

Current information for magnetic declination was derived from the National Geophysical Data Center (NGDC) database in October of 2008. Magnetic Declination for the RTS area was calculated as 14°30' East changing by 0°6' West per year. True bearing for each runway were identified through the most recent Airport Layout Plan (ALP) for RTS. Magnetic bearing calculations for each RTS runway are shown in **Table 4-9** below.

Table 4-9. Runway Designation Calculation

Runway	True Bearing	Magnetic Declination	Magnetic Bearing	Runway Designation Required
8	96°43'45"	-14°30' East	82°13'15"	8
26	276°43'15"	-14°30' East	262°13'15"	26
14	154°25'2"	-14°30' East	140°55'2"	14
32	334°25'2"	-14°30' East	320°55'2"	32

Source: PBS&J, 2008

Considering the current true bearing of Runway 8-26 and 14-32 and the calculated magnetic declination for the Reno-Stead area, no re-designation of runways at RTS is required. Furthermore, assuming the declination of 14°30' East changing by 0°06' West per year remains constant, the need for re-designation of RTS runways will not be realized for another 30 to 40 years.

4.3.2.4 Runway Length Requirements

The length of a runway is a function of many factors, the most notable of which are the selection of a critical aircraft and the longest nonstop distance being flown by this aircraft from the airport of study. These factors were used as input for the FAA's Airport Design v4.2D software, utilizing the airport elevation of 5,050 feet mean sea level (MSL), a

mean daily maximum temperature of the hottest month of 89.6 degrees Fahrenheit, a maximum difference in runway centerline elevation of 58.3 feet, an average length of haul of 1,000 miles, and wet and slippery runway conditions. The results are depicted in **Table 4-10.**

Table 4-10. Runway Length Requirements

Airport and Runway Data:	
Airport Elevation (MSL)	5,050
Mean Daily Maximum Temperature of the Hottest Month	89.6° F
Maximum Difference in Runway Centerline Elevation	58.3 Feet
Recommended Runway Lengths:	
Small Aircraft with Approach Speeds of Less Than 30 Knots	450 Feet
Small Aircraft with Approach Speeds of Less Than 50 Knots	1,200 Feet
Small Aircraft with Less Than 10 Passenger Seats:	
75 Percent of These Small Aircraft	4,640 Feet
95 Percent of These Small Aircraft	6,230 Feet
100 Percent of These Small Aircraft	6,400 Feet
Small Aircraft with 10 or More Passenger Seats	6,400 Feet
Large Aircraft of 60,000 Pounds or Less:	
75 Percent of These Large Aircraft at 60 Percent Useful Load	7,250 Feet
75 Percent of These Large Aircraft at 90 Percent Useful Load	9,180 Feet
100 Percent of These Large Aircraft at 60 Percent Useful Load	11,280 Feet
100 Percent of These Large Aircraft at 90 Percent Useful Load	11,580 Feet
Aircraft of More Than 60,000 Pounds:	
Traveling 1000 or Less Non-Stop Miles to Destination	8,050 Feet

Source: FAA AC 150/5325-4A, Runway Length Requirements for Airport Design.

It is evident from the runway length requirements table above that RTS's runways satisfy the length requirement for all small airplanes with up to and greater than 10 passenger seats. Both runways are capable of handling large aircraft of 60,000 pounds or less considering certain load parameters established by each aircraft's independent performance data and most importantly, are able to support operations by the airport design aircraft, 737-900, traveling less than 1,000 miles. As a result, the current runway lengths are considered adequate for the duration of the 20-year planning period.

4.3.2.5 Taxiway Requirements

A taxiway system should allow for safe and efficient movement of aircraft to and from the runways and aircraft parking/storage areas which serve the airport's facilities. The ARC C-III designations and protective surfaces mentioned previously also apply to taxiways. As traffic increases, the taxiway system can become a limiting factor of the airport overall capacity, especially if the configuration of the airport results in frequent runway crossings by taxiing aircraft, or does not provide sufficient access to airport facilities or provide bypass capability. FAA guidance found in FAA Advisory Circular 150/5300-13, *Airport Design* recommends that a taxiway system should: provide each runway with a

full parallel taxiway, have as many by-passes, multiple accesses, or connector taxiways as possible to each runway end, provide taxiway run-up areas for each runway end, have the most direct routes as possible, have adequate curve and fillet radii, and avoid areas where ground congestion may occur.

The existing taxiway system at RTS, as discussed in Chapter 2, connects all runway ends to the terminal area and other airport facilities. Runway 14-32 is served by parallel Taxiway B which extends from the Runway 14 end to the Runway 32 end. Taxiway B is 50 feet wide and has 400 feet of separation from its centerline to the Runway 14-32 centerline. The 400 feet of separation and 50-foot width meets FAA ARC C-III requirements.

Runway 8-26 is served by parallel Taxiway A on the south side of the runway, adjacent to the apron. Taxiway A is 50 feet wide and has a runway centerline to taxiway centerline separation of 520 feet. Taxiway A meets and exceeds FAA ARC C-III standards.

In addition to the primary parallel taxiways, other secondary taxiways on the airfield connect the runways and taxiways to the terminal, aprons, and GA facilities. Taxiway C is located in the middle of the airfield between Runway 14-32 and Runway 8-26 and provides service to both runways. Taxiway C connects to Taxiway B and Taxiway A. Taxiway D connects the approach end of Runway 8 to the Nevada Army National Guard building and to Taxiway A; however, it only has a weight bearing capacity of 14,000 pounds to support the Nevada Army National Guard's Beech King Air aircraft.

Even though the demand capacity analysis determined that the existing facilities will be sufficient, the inclusion of additional full-length parallel taxiways for both Runway 8-26 (north side) and Runway 14-32 (east side) would increase levels of safety related to aircraft operations, especially considering RTS is currently an uncontrolled facility (no air traffic control). Furthermore, these taxiway additions would allow for development on areas of RTS that currently have no runway access, as well as allow for a more efficient flow of aircraft and ground operations. As a result, it is recommended that full parallel taxiways on the north side of Runway 8-26 and on the east side of Runway 14-32 be implemented in the 20-year planning horizon. It is also recommended that improvements to Taxiway D in the form of strengthening, adding appropriate fillet radii, and marking appropriately be performed during the planning period.

4.4 APPROACH AND NAVIGATIONAL AIDS

As discussed in Chapter 2, RTS has several navigational and visual approach aids. These consist mainly of Precision Approach Path Indicators (PAPIs), lighted windsocks, a lighted segmented circle, and an ILS. A non-precision GPS approach is also available at RTS.

Future NAVAIDS that may be considered in order to increase operational efficiency and ensure safety during IFR operations include the installation of an ILS on Runway 8-26 along with a medium-intensity approach lighting system with runway alignment indicator lights (MALSR). Considering Runway 26 is used over 72 percent of the time it is appropriate to protect this runway for use during times of inclement weather through the implementation of an ILS.

4.5 AIRFIELD LIGHTING, SIGNAGE, AND PAVEMENT MARKINGS

4.5.1 Airfield Lighting

Airport lighting aids assist pilots in identifying an airport facility and while maneuvering

on the airfield. The existing lighting aids at RTS include a rotating beacon, runway end identification lights (REILs), high intensity runway lights (HIRLs), and medium intensity taxiway lights (MITLs).

Runway 14-32 and Runway 8-26 are both equipped with REILs and HIRLs. Parallel Taxiways A and B are equipped with MITLs, and no taxiway lighting exist on Taxiways C and D. As a result, the only airfield lighting improvement recommended is that MITLs should be considered for all taxiways at RTS.

4.5.2 Airfield Signage

Existing airfield signage at RTS is adequate for the current facilities; however, signage improvements should be considered in conjunction with airfield projects. For instance, the RSA improvements will require new distance remaining signs to both runways. Additionally, signage that clearly designates the terminal location may be helpful for arriving transient aircraft.

4.5.3 Pavement Markings

Each runway except for Runway 32 is marked with visual basic markings, Runway 32 is marked as precision as it has an ILS approach. All runways are marked with runway number designations, centerline stripes, and runway side stripes. The displaced threshold on Runway 14 is marked appropriately with arrows. It is recommended that the pavement marking system at RTS be evaluated with any physical change to any surface used during aeronautical activity. Pavement markings should be appropriately relocated to coincide with the completion of any runway and/or taxiway extensions and improvements or construction of an additional apron area.

4.6 AIRCRAFT APRONS AND TIE-DOWNS

Aircraft aprons are areas that provide parking for airplanes, access to the terminal facilities, fueling, and ground transportation. FAA Advisory Circular 150/5300-13, *Airport Design* provides guidelines for sizing aircraft aprons based on the number of airplanes using the airport during a busy day. At RTS, the total operations can be classified in two categories: based aircraft operations and itinerant aircraft operations. Aircraft aprons and tie-downs were analyzed for each category in accordance with FAA guidance.

A single publicly accessible aircraft parking apron exists at RTS. The apron is located directly south of Runway 8-26 and is approximately 215,000 square yards in total size of which 204,000 is paved with asphalt. The remaining 11,000 square yards of apron is constructed of concrete and used for parking of larger aircraft. Roughly 76,300 square yards of the apron is currently used as tie-down space for based aircraft, and 33,220 square yards is used as tie-down space for itinerant aircraft. The based aircraft tie-down area is located west of the temporary grandstand site and north of the T-hangars while the itinerant tie-down area is located adjacent to the FBO on the east end of the apron. During the National Championship Air Races and Air Show, nearly all of the apron is utilized: the center portion south of the apron is the site for temporary grandstands and box seating; the west end is used as the racing aircraft pit area; and the east end is used for military aircraft display. Also, the extreme east end of the apron is used to stage fire fighting aircraft during operations by the Bureau of Land Management (BLM) fire fighting support base.

It has been estimated that 20 percent of based aircraft at RTS are not in hangars and will require apron space. Sizing criteria for tie-down positions vary according to aircraft size, including space for circulation and fueling. FAA AC 150/5300-13, *Airport Design*,

indicates that planning for 300 square yards for each based aircraft will provide sufficient space for a mix of aircraft. The based aircraft apron calculations are shown in **Table 4-11.**

Table 4-11. Based Aircraft Apron Requirements

	2006	2010	2015	2020	2025	2030
Total Based Aircraft	261	318	356	404	464	539
Based Aircraft on Apron (20% of total)	52	64	71	81	93	108
Total Based Aircraft Apron (sq. yards)	**15,600**	**19,200**	**21,300**	**24,300**	**27,900**	**32,400**
Existing Based Aircraft Apron (sq. yards)	76,300	76,300	76,300	76,300	76,300	76,300
Surplus / (Deficiency) in sq. yards	**60,700**	**57,100**	**55,000**	**52,000**	**48,400**	**43,900**

Source: PBS&J, 2008.

Based on the above analysis, ample apron space is available to facilitate the growing tie-down demand of local based aircraft throughout the 20-year planning period.

Itinerant apron space is intended for relatively short-term parking periods, usually less than 24 hours, as they are primarily for transient aircraft. When possible, such aprons should also be located as to provide easy access to the terminal, fueling, and ground transportation facilities. For planning purposes, the FAA provides a detailed approach to calculate the total number of peak day itinerant aircraft that can be expected on the apron at any given time. For RTS, this was calculated by adding 10 percent to the peak month average day (PMAD) activity figures from the forecast chapter to determine busy day operations. The corresponding local/itinerant split was applied to determine peak day itinerant operations (in this case 45.3 percent). It was assumed that 50 percent of transient aircraft will occupy the apron at any given time. The size of an itinerant apron should be based upon a minimum are of 360 square yards per itinerant aircraft. The itinerant aircraft apron calculations are shown in **Table 4-12.**

Table 4-12. Itinerant Aircraft Apron Requirements

	2006	2010	2015	2020	2025	2030
Busy Day Ops (PMAD OPS + 10%)	348	471	528	598	688	799
Peak Day Itinerant Operations	158	213	239	271	312	362
Transient Aircraft Positions Required	79	107	120	136	156	181
Total Transient Apron Required (sq. yards)	**28,440**	**38,520**	**43,200**	**48,960**	**56,460**	**65,460**
Existing Itinerant Apron (sq. yards)	33,220	33,220	33,220	33,220	33,220	33,220
Surplus / (Deficiency) in sq. yards	**4,780**	**(5,300)**	**(10,000)**	**(15,740)**	**(23,240)**	**(32,240)**

Source: PBS&J, 2008.

Based on the above analysis, the existing itinerant aircraft apron, as striped and equipped, is expected to experience capacity issues in the near future. It is recommended that additional tie-down positions be striped and equipped as needed using a portion of the approximately 95,000 square yards of unassigned space in the center of the apron area. The expanded tie-down area for itinerant aircraft should be located west of the FBO hangar (Aviation Classics) and east of the grandstands.

In conclusion, the existing paved aircraft apron area is adequate to meet the 20-year planning demand with only minor modifications required to facilitate increased operations.

4.7 AIRCRAFT HANGARS

Aircraft hangars provide aircraft with protection from the weather and security against vandalism or theft. In general, aircraft owners, if financially capable, prefer to store their aircraft in hangars than on the apron. Currently there are T-hangars and conventional hangars located at RTS.

T-hangars, as well as T-shelters or shade hangars, are row hangars that nest aircraft in a line, usually alternating nose to tail, maximizing utilization of available space. These are relatively low-cost hangars which provide complete or partial protection from the elements depending on whether they are open (shade hangar) or enclosed. A conventional hangar is typically a rectangular structure with sliding doors, usually accommodating more than one aircraft and having some additional space for other equipment or office space.

Requirements for hangars tend to vary greatly from airport to airport but are dependent on similar factors. These factors include: the number and type of based aircraft, local preference for hangar type, associated fees, and local climate conditions including severity of seasonal changes.

Currently 102 hangars exist at RTS and include nine T-hangar units and 93 conventional hangars. All hangars are located along the south and west sides of the aircraft parking apron. Recently, new taxilanes were developed on the west end of Runway 8-26 to facilitate the addition of 60 conventional hangars, which are expected to be built within the next one to three years.

For planning purposes, it was assumed that 80 percent of total based aircraft will require hangar space. As is the case currently, aircraft may be located in T-hangar units, small standalone hangars, or collocated with other aircraft in a larger conventional hangar. As such an average of two aircraft per hangar was applied. Discussions with RTAA staff indicate the growth in hangars at RTS would be in conventional hangars rather than T-hangar units. Therefore, the number of T-hangar units remains constant through the planning period. Hangar requirements are noted in **Table 4-13**.

Table 4-13. Aircraft Hangar Requirements

	2006	2010	2015	2020	2025	2030
Total Based Aircraft	261	318	356	404	464	539
Total Aircraft Hangars Required [2]	**104**	**127**	**142**	**162**	**186**	**216**
Total Existing Aircraft Hangars [1]	102	132	162	162	162	162
Surplus / (Deficiency)	**(2)**	**5**	**20**	**0**	**(24)**	**(54)**

Notes: [1] Total existing aircraft hangars include the assumption that 30 new hangars currently under construction will be available in 2010 and the remaining 30 hangars will be available in 2015.
[2]Total aircraft hangars required assumes an average of 2 aircraft per hangar.
Source: PBS&J 2008.

4.8 FUEL FLOWAGE

Two fuel storage facilities exist at RTS. One is located south of Runway 8-26 and east of the Aviation Classics hangar and contains one 12,000 gallon Jet-A tank and two 12,000 gallon 100LL (AVGAS) tanks. The other fuel storage facility is a single 12,000 gallon AVGAS tank located in the middle of the itinerant apron area and used as a self service fuel station. All the fuel facilities are currently managed by the FBO Aviation Classics.

Historical fuel flowage information was provided by RTAA staff, and was used to forecast the annual fuel demand over the planning period as well as the 14-day storage requirement over the planning period. Based on the fuel flowage projections described in Chapter 3, it is estimated that 964,307 total gallons of fuel (specifically 565,160 gallons Jet-A and 399,147 gallons AVGAS) will be sold annually by 2030. The forecast of flowage volumes are summarized in **Table 4-14.**

Table 4-14. Annual Fuel Demand

Year	Annual Non-Jet Operations	Gallons Per Operation	Annual AvGas Demand
2006	59,238	3	157,401
2010	79,434	3	238,302
2015	88,416	3	265,248
2020	100,058	3	300,174
2025	114,745	3	344,235
2030	133,049	3	399,147
Year	**Annual Jet Operations**	**Gallons Per Operation**	**Annual Jet-A Demand**
2006	4,672	40	190,638
2010	7,379	40	295,160
2015	8,851	40	354,040
2020	10,258	40	410,320
2025	11,905	40	476,200
2030	14,129	40	565,160

Source: PBS&J, 2009.

Tables 4-15 and **4-16** provide the on-site fuel storage requirements for both AVGAS and Jet-A, respectively. The gallons per operation provided in Table 4-14 was held constant. Average daily operations were determined by dividing the total annual number of operations by 365. The Peak period was determined by applying a 15 percent factor to the average daily number of operations calculated. Based on the existing convenient and reliable fuel delivery services in the region, it was assumed for planning purposes that a 14-day storage requirement would provide enough on-site capacity to meet demand during the peak period.

Table 4-15. AVGAS Fuel Storage Requirements

Year	Daily Non Jet Operations		Gallons Per Operation	14-Day Storage Requirement Gallons	
	Average	*Peak*		*Average*	*Peak*
2006	163	187	3	6,846	7,854
2010	218	250	3	9,156	10,500
2015	242	279	3	10,164	11,718
2020	274	315	3	11,508	13,230
2025	314	362	3	13,188	15,204
2030	365	419	3	15,330	17,598

Source: PBSJ 2009.

Table 4-16. Jet A Fuel Storage Requirements

Year	Daily Jet Operations		Gallons Per Operation	14-Day Storage Requirement Gallons	
	Average	*Peak*		*Average*	*Peak*
2006	7	8	40	7,280	8,400
2010	20	23	40	11,200	12,880
2015	24	28	40	13,440	15,680
2020	28	32	40	15,680	17,920
2025	33	38	40	18,480	21,280
2030	39	45	40	21,840	25,200

Source: PBS&J, 2008.

These calculations show strong growth in demand for fuel at RTS over the next 20 years. As demand increases FBOs typically react by increasing fuel shipments or expanding their on-site capacity. Space should be allocated for expansion of existing fueling facilities to meet this demand. Demand for AVGAS can be accommodated with the existing 24,000 gallon storage capacity. However, an additional Jet-A self-serve fueling system should be considered to support fuel demand of jet aircraft during the planning period. This could increase the efficiency of the fueling operations and potentially reduce fuel consumer costs. This particularly attracts price-sensitive general aviation operators and cost reductions are passed on to the consumer. Such factors should be considered in the planning process and coordinated with the FBO.

4.9 TERMINAL BUILDING & FBO

As addressed in Section 2.15 Airport Surveys and Tenant Interviews, public input and surveys indicated a strong desire for a terminal facility to provide proper pilot and passenger services, adequate pilot support, and public meeting/waiting areas at RTS. Copies of these surveys are found in Appendix B. General Aviation terminal buildings typically range from modest structures with little more than a waiting area and a telephone, to multi-story buildings with extensive amenities. A general aviation administration/terminal building should provide at the very least: office space, a waiting room for pilots and passengers, an area for food and drink vending, a public telephone, and public restrooms. RTS does have a modular building set up as a terminal building, though office space is not provided (the airport manager's office is in a different building), and the terminal overall is somewhat small. The terminal building at RTS has approximately 1,700 square feet of space which consists primarily of a pilot lounge with flight planning area, restrooms, and storage facilities. Historically, the on-site FBO has provided the bulk of terminal services offered at RTS. A new terminal building is recommended.

Appendix 5 of FAA AC 150/5300-13, *Airport Design* provides guidance for small airport buildings, including GA terminals. The primary consideration is that the facility be capable of handling the number of passengers, pilots, and visitors associated with peak hour operations. GA facility sizing can vary from 50 to 75 square feet per peak hour passenger. Considering the level of air taxi and corporate operations forecast over the 20-year planning period, a planning guide of 75 square feet per peak hour passenger was used to determine the overall terminal size at RTS.

Floor space requirements for each area are a function of the anticipated number of peak

hour operations and airport users. Peak hour passengers are computed as 1.5 passengers per each local aircraft arrival and 2.5 passengers per itinerant arrival. A 55/45 percent mix of local/itinerant activity is assumed throughout the 20-year planning period. Floor space requirements, expressed in square feet per passenger, are as follows for general aviation terminal facilities: Waiting Lounge, 25; Office Space, 5; Public Conveniences, 10; Concession/Vending, 10; and Storage, Circulation, and HVAC, 25 square feet per passenger. Terminal building size requirement recommendations are shown in **Table 4-17**.

Utilizing the above referenced sizing criteria and based on the current and forecast level of demand, a 9,825 square-foot general aviation terminal will be required by 2030. This space will provide room for the airport administration offices and a better space for pilot flight planning and passenger lounging. Since the existing building is not expandable, a new replacement building is recommended.

4.10 TERMINAL AREA AUTOMOBILE PARKING

A clearly defined parking area near the airport terminal building is considered a necessity for a modern airport, and serves as a point of reference for first time visitors of the facility. The primary automobile parking area at RTS is located west of the Air Traffic Control Tower, and south of the grandstands. At the moment, roughly 3,500 square yards of unpaved area is available for the parking of automobiles in this area. This parking area is assumed to have a capacity of about 80 vehicles when the space is used at peak efficiency; however, as the parking lot is neither paved nor striped, no real control on where and how automobiles park exists. Additionally, small pockets of land are used for vehicle parking up and down the length of the aircraft apron area as they are convenient for many of the tenants. These informal spaces used by individual tenants make it difficult to quantify RTS's automobile parking capacity.

The number of automobile parking spaces required is generally calculated as a function of peak hour users as well as tenant and employee demand. However, as other areas are used for tenant and employee parking, this analysis will review only peak hour airport users. A standard of 35 square yards per automobile parking space was used to establish the requirements shown in **Table 4-18**.

The automobile parking requirements analysis for the terminal area reveals that the current area available for the parking of automobiles is adequate until 2020. However, a paved, striped, and clearly identifiable public parking area near the terminal area is recommended to be constructed in conjunction with the development of a new terminal building. A more in depth review of parking lot requirements should also be completed as part of the terminal development process.

4.11 GROUND ACCESS

As mentioned in Chapter 2, the primary ground access to the airport is via Highway 395. RTS is approximately three miles north of this major highway, which runs through Spokane, Washington; Reno, Nevada; and San Bernadino, California. The major arterial road to RTS from 395 is Stead Boulevard. Additional access roads to RTS include Moya Boulevard from Red Rock Road on the southwest side of RTS and Military Road from Lemmon Drive on the southeast side of RTS. All of these access roads ultimately connect to 395 to the south of RTS.

Table 4-17. Terminal Building Requirements

	Base Year	Forecast				
	2006	2010	2015	2020	2025	2030
Peak Hour Operations	38	45	49	54	60	67
Peak Hour Users	74	88	96	105	117	131
Waiting Lounge	1,850	2,200	2,400	2,625	2,925	3,275
Office Space	740	880	960	1,050	1,170	1,310
Public Conveniences	370	440	480	525	585	655
Concession/Vending	740	880	960	1,050	1,170	1,310
Storage, Circulation, HVAC	1,850	2,200	2,400	2,625	2,925	3,275
Total Area (sq. feet)	**5,550**	**6,600**	**7,200**	**7,875**	**8,775**	**9,825**
Existing (sq. feet)	1,700	1,700	1,700	1,700	1,700	1,700
Surplus / (Deficiency)	**(3,850)**	**(4,900)**	**(5,500)**	**(6,175)**	**(7,075)**	**(8,125)**

Source: PBS&J, 2008.

Table 4-18. Automobile Parking Requirements

	Base Year	Forecast				
	2006	2010	2015	2020	2025	2030
Peak Hour Airport Users	74	88	96	105	117	131
Parking Area Required (sq. yards)	**2,590**	**3,080**	**3,360**	**3,675**	**4,095**	**4,585**
Existing (sq. yards)	3,500	3,500	3,500	3,500	3,500	3,500
Surplus / (Deficiency)	**1,330**	**420**	**140**	**(165)**	**(595)**	**(1,085)**
Existing No. of Spaces	80	80	80	80	80	80
Required No. of Spaces	**59**	**70**	**76**	**84**	**93**	**104**
Surplus/ (Deficiency)	**21**	**10**	**4**	**(4)**	**(13)**	**(24)**

Source: PBS&J 2008.

Although Moya Boulevard, Stead Boulevard, and Military Road provide adequate access to RTS from Highway 365, the entrance to RTS is hidden in a maze of business and residential development and is not abundantly obvious to visitors approaching RTS. As corporate and air taxi activity, as well as overall demand, increase at RTS, a new entrance to RTS should be developed. The new entrance location should create more direct access to the new terminal building and the primary public parking area, as well as make the overall location of the airport itself evident to visitors and RTS customers through the use of additional signage. The new entrance road should avoid high-density industrial commercial real estate areas as much as possible.

Improvements of this nature would increase vehicular capacity in order to accommodate the anticipated growth of RTS as well as seasonal/event traffic associated with the National Championship Air Races and Air Show. Furthermore, a new access road and associated identity structure (terminal building) would give RTS much better frontage and presence within the community and facilitate the overall use of RTS by business, customers, and passengers.

4.12 AIRPORT SECURITY

A full perimeter fence and full perimeter unpaved road surround all airport properties with the exception of approximately 425 acres located on the ridgeline in the northeast corner of RTS. The perimeter fence is six feet tall and is effective in preventing transient animals from entering airport property. Also, a smaller inner fence surrounds the areas of airport property close to the airfield. Depictions of the fence locations can be found on the ALP set in Chapter 7.

As additional safety measures, any future property acquired by RTS should be fenced and any additional buildings or parking areas constructed on RTS property should have

adequate security lighting. Also, the use of additional security cameras at key locations (i.e., remote gate locations, hangars, and corporate buildings) should be implemented.

4.13 AIRPORT RESCUE AND FIREFIGHTING

The City of Reno provides Aircraft Rescue and Fire Fighting (ARFF) services for RTS. Fire Station No. 9, owned and operated by the City of Reno, is equipped with an airport-assigned rescue vehicle that is available to RTS. Fire Station No. 9 is located less than one mile south of RTS on Mount Vida Street.

Since RTS is a GA facility and does not have commercial service, and/or Part 139 certification, ARFF services are not required to be located on RTS property. Therefore, the ARFF services provided by the City of Reno are adequate for the existing and forecast level of operations. As corporate and air taxi operations increase, RTS's fire safety needs should be monitored to ensure adequate facilities are in place to accommodate any significant change in activity.

4.14 AIR TRAFFIC CONTROL TOWER

The need for establishing air traffic control tower (ATCT) services at an airport that has historically been uncontrolled is generally associated with an increasing level of aircraft operations combined with diversity in fleet mix. Often corporate and/or military aircraft combined or interspersed with primary flight training, recreational flights and other activities using the same airfield will generate conflicts that may compromise safety unless the airspace in the immediate area of the airport (e.g., traffic pattern) is controlled.

Air Traffic Control Tower services enhance the safety of an airport's airspace and airfield by managing aircraft departure and arrival operations, ground vehicles and other activities. The benefits derived from establishing an ATCT include:

- avoidance of mid-air collisions
- prevention of other accidents (runway incursions)
- flight efficiencies

The FAA's Air Traffic Division operates air traffic control towers using both FAA owned and operated facilities and through contract agreements with qualified ATC contractors on a regional basis. This Contract Tower program has proven to be very effective in significantly reducing the cost of providing air traffic control services so that many locations which would not have otherwise been able to justify the expense of providing controlled airspace can benefit from the services of an FAA-funded Air Traffic Control Tower facility.

The justification process for FAA's funding of the operation of contract tower locations is primarily determined by a Benefit/Cost analysis. FAA Report APO 90-7, *Establishment and Discontinuance Criteria for Air Traffic Control Towers*, outlines the procedures for calculating Benefit/Cost (B/C) ratios. Costs are those direct costs associated with the annual operation of the Control Tower including labor and other expenses. Benefits are measured in terms of lives and property saved by the prevention of mid-air collisions, other accidents and the savings in flight time by providing controlled airspace around RTS. The benefit of the Control Tower must be greater than the cost (benefit/cost ratio of greater than 1.0) in order to qualify for funding under the FAA's Contract Tower program.

Construction of the Control Tower and installation of ATCT equipment is eligible for

funding under the Airport Improvement Program (AIP) if the tower will be used in the Contract Tower Program and can be justified with a B/C greater than 1.0. Upon meeting this threshold, the Airport Sponsor is responsible for the design, construction, and maintenance of the ATCT facility and equipment and the FAA agrees to fund the annual cost of staffing the Tower.

4.14.1 Critical Values and Other FAA Assumptions

The FAA in the B/C analysis process uses various "critical values" that represent the generic cost of specific items and are set by the General Accounting Office (GAO). The critical values for items used in the B/C Analysis are provided in **Table 4-19**.

Table 4-19. FAA Critical Values & Assumptions

Item	Value
Statistical Life	$5,800,000
Serious Injury	$830,000
Minor Medical Injury	$18,000
GA Traveler's Time (per hour)	$32.50
Other Traveler's Time (per hour)	$27.90
Discount Rate (for net present value)	7%

Source: FAA Office of Policy and Plans (Base Year 2007).

Generally, FAA policy considers new entrants into the Contract Tower Program initially using the establishment criteria of APO 90-7 which applies the statistical means for accident risk as a primary factor in the B/C calculations. Also, for new entrants, projected operations are discounted by 7.5 percent to account for the number of operations that would not be handled by an ATCT facility open for at least 12 hours daily. The establishment period for new ATC Tower facilities entering the Contract Tower Program generally applies to the first one to two years of operation, depending on the point the control tower enters the program since the FAA calculates the B/C biennially. All subsequent calculations of the B/C ratio by the FAA after the initial establishment period are conducted using the discontinuance criteria.

While aircraft activity is associated with the benefit side of the equation, costs are represented by the initial cost of construction of the ATCT facility, annual maintenance costs and FAA's annual cost to operate the ATC as charged by the regional FAA contractor. Estimated construction costs for a Contract ATCT facility can range from $1.5 million to $3.0 million and greater, depending on the required height to meet safety standards, structure materials and other variables. A cost of $5.0 million was used as an estimate for the construction of an ATCT at RTS. Annual maintenance costs to cover utilities, equipment servicing, and other items were estimated at $25,000. Generally, under the Federal Contract Tower program, the FAA uses a figure of $450,000 which represents the average of all contract towers in the program as an estimate of the annual ATC costs for new applicants. The construction cost is only used for the initial year of operation while the annual maintenance and ATC operations costs are held constant throughout the 15-year period and are only adjusted for net present value.

It should be noted that once the Contract ATC Tower has been established, for subsequent years, the B/C calculation is conducted using a separate discontinuance criteria which considers the upper bounds of the statistical risk of accidents. Also, aircraft operations are no longer discounted by 7.5 percent in the discontinuance scenario since it is assumed that all operations handled by ATC are counted.

4.14.2 Benefit/Cost Analyses

A Benefit/Cost Analysis was developed using the airport's projection of based aircraft and the future operational activity in Chapter 3. The discounted cumulative (15-year) ATCT cost was determined to be $6,379,681. The discounted value of the ATC tower benefits is calculated to be $11,787,889 with the resultant B/C at 1.85. Under this scenario, RTS would be an eligible candidate to enter the Contract Tower Program with the FAA covering the entire operational costs of the new ATC Tower location. **Appendix C** contains the detailed calculations for the Benefit/Cost Analysis.

4.15 NON-AVIATION USE

Recognizing the value of real estate within and adjacent to RTAA property that is best suited for non-aviation use, RTS has an opportunity to capitalize on its development enabling RTAA to diversify revenue sources and utilize land to the fullest extent possible. Development of business centers, industrial parks, and commerce areas can be extremely valuable resources in the realization of that goal. Careful planning and organization of these non-aviation revenue generators can be vital to the financial independence of the airport and funding of either landside or airside improvements of the airport.

4.16 SUMMARY

This chapter has identified the general facility requirements necessary to meet the 20-year forecast of aviation demand. A summary of the general facility requirements has been compiled in **Table 4-20**. The next chapter will provide the alternatives developed in order to meet projected facility needs.

Table 4-20. Summary of Facilities Requirements

Item	Existing (2006)		Planning Stage Requirements 2010		2020		2030	
Airside Facilities								
Runway	**14-32**	**8-26**	**14-32**	**8-26**	**14-32**	**8-26**	**14-32**	**8-26**
- Length/Width	9,000'/150'	7,608'/150'	No Change		No Change		No Change	
- Strength	75,000 SW	60,000 SW	No Change		No Change		No Change	
Taxiway System								
- Runway 14-32	Full Length Parallel B		No Change		No Change		East Parallel Twy Addition North Parallel Twy	
- Runway 8-26	Full Length Parallel A		No Change		No Change		Addition	
- Other					Enhance Twy D			
Landside Facilities								
Aircraft Apron Area								
- Based Aircraft Tie-down	52 Spaces		64 Spaces		81 Spaces		108 Spaces	
- Based Aircraft Tie-down	76,300 Sq. Yd.		No Change		No Change		No Change	
- Itinerant Aircraft Tie-down	79 Spaces		107 Spaces		136 Spaces		181 Spaces	
- Itinerant Aircraft Tie-down	33,220 Sq. Yd.		43,220 Sq. Yd.		53,220 Sq. Yd.		65,000 Sq. Yd.	
Aircraft Hangars								
- T-Hangars	9		9		9		9	
- Conventional Hangars	95		118		153		207	
Fuel Facilities								
- Jet-A Tanks	12,000 Gal.		13,000 Gal.		18,000 Gal.		25,000 Gal.	
- AvGas Tanks	36,000 Gal.		No Change		No Change		No Change	
Terminal Buildings								
- Airport Terminal Building	5,550 Sq. Ft. [1]		6,600 Sq. Ft.		7,875 Sq. Ft.		9,825 Sq. Ft.	
Automobile Parking								
- Parking Spaces	80 [2]		70		84		104	
- Parking Area	3,500 Sq. Yd. [2]		3,080 Sq. Yd.		3,675 Sq. Yd.		4,585 Sq. Yd.	

Notes: 1. The existing terminal services are being provided in old and inappropriate facilities that are unable to expand. As a result, a new replacement terminal building is recommended.
2. The existing public parking area is a dirt lot which is not adjacent to the terminal facilities. As a result, a new paved parking lot adjacent to the new terminal building is recommended.
Source: PBS&J, 2009.

AIRPORT DEVELOPMENT PLAN

Reno-Stead Airport

5

5.1 GENERAL

The primary objective of this chapter is to present the overall phased development plan for the Reno-Stead Airport (RTS) to meet future facility development needs identified in Chapter 4. This chapter will present a recommended facility development plan for both aviation use and non-aviation use areas of RTS and is supplemental to the Airport Layout Plan (ALP) associated with this master plan. Airport elements that will satisfy the anticipated aviation demand and/or meet the development goals of the Reno-Tahoe Airport Authority (RTAA) have been identified and accounted for in this chapter. The development plan will be a guide for airport management in directing the future development of RTS. However, the guidelines established must be flexible enough to allow management to adapt to changing aviation demands.

5.2 APPROACH

To help formulate the recommendations for the RTS development plan, four factors which impact how the airport will develop over the 20-year planning horizon have been identified. These factors are:

- RTS plays an important role in the regional and national airport system. RTS supports many aviation activities including general aviation (GA), Nevada Army National Guard (NVANG) operations, Bureau of Land Management (BLM) Air Tanker operations, and Reno Air Racing Association (RARA) National Championship Air Races and Air Show. RTS also serves as a reliever airport for Reno-Tahoe International Airport (RNO).
- RTS has a relatively large land area (5,170 acres), the majority of which is undeveloped and located away from the immediate airfield.
- The *Reno-Stead Airport Regional Center Plan* from 2003 defined the RTS property as a Mixed-Use District. This plan envisions airport compatible development across RTS property, which in addition to aviation uses may include large scale industrial, office, commercial, and public facility developments. Additionally, the plan acknowledges that residential development and other public development such as schools and churches are incompatible land uses for RTS.
- The *Reno-Stead Airport Regional Center Plan* from 2003 also proposes a new circulation concept for the expansive airport property. This circulation concept was included in the RTS Development Plan.

The RTS development plan is presented in the following separate but interrelated functional areas:

- Airfield Elements
- Landside Elements
- Airport Development Concept
- Development Plan

5.3 AIRFIELD ELEMENTS

Runways and taxiways are, by their very nature, the focal point of an airport complex. Because of their role, restrictive placement flexibility, and the fact that they physically dominate a great deal of an airport's property, airfield facility needs are the cornerstone of airport development concepts. In particular, the runway system requires the greatest commitment of land area and is the greatest influence on the identification and development of other airport facilities.

The potential for physical expansion of an airport to accommodate airfield development is a primary factor that determines long-term expansion. Runway and taxiway systems directly affect the efficiency of aircraft movements both on the ground and in the surrounding airspace. Thus, the overall capacity of an airport to accommodate aviation activity is directly related to the efficiency and capabilities of the airfield system. Additionally, runway and taxiway systems can limit the ability of an airport to handle certain aircraft, which can directly affect the types of air service an airport can accommodate.

RTS's existing airfield configuration consists of two runways, Runway 8-26 and Runway 14-32, along with their supporting taxiways and taxilanes. These facilities accommodate the current fleet mix and air traffic levels; however, the airfield's volume of aircraft operations is projected to steadily increase throughout the planning period. Chapter 4 *Demand/Capacity Analysis and Facility Requirements* identified areas for improvement on the airfield to mitigate capacity issues while encouraging growth. These improvements are discussed in detail below.

5.3.1 Runway Improvements

The following sections outline the runway improvements that are deemed as necessary for RTS to gain maximum capacity, meet the forecast aviation demand, and provide facilities in line with the development goals of RTAA.

5.3.1.1 Implement Declared Distances on Runway 8-26 and Displace Runway 26 Threshold for RSA Compliance

Runway 8-26 is the most frequently used runway at RTS and is approximately 7,608 feet long by 150 feet wide. Section 4.3.2.1 Runway 8-26 revealed that the Runway Safety Areas (RSAs) associated with Runway 8-26 are not in full compliance with current FAA standards. To address this issue, RTAA contracted with URS Corporation to evaluate the RSAs at RTS and offer recommendations for improvements. The *Reno-Stead Airport RSA Standards Compliance Study Final Report, October 2008* prepared by URS Corporation recommended the construction of a 575-foot westerly extension to Runway 8-26 and implementing 575-foot displacements on both the 8 and 26 runway ends. As discussed in Section 4.3.2.1 Runway 8-26, the initially recommended alternative was replaced, in January 2010, with a less expensive, but better operational, solution.

The application of declared distances on Runway 8-26 and use of a displaced threshold on Runway 8-26 will allow RTS to meet takeoff requirements and overall demands of current and projected aircraft while minimizing off-airport land use impacts and obstruction concerns. A categorical exclusion (CatEx) as well as an AIP grant application for the revised project construction was submitted to the FAA in January 2010. These improvements are expected to be completed by the end of 2010. It must also be noted that during the planning period the rehabilitation of Runway 8-26's pavement, which has been in place for 15 years, would be necessary.

5.3.1.2 Implement Declared Distance on Runway 14-32 for RSA Compliance

Runway 14-32 is also designated for Group III traffic according to the ALP. Runway 14-32 was found to have a non-compliant RSA associated with Runway 32. The *Reno-Stead Airport RSA Standards Compliance Study Final Report, October 2008* prepared by URS Corporation recommends, after considering other viable alternatives, remarking the end of Runway 32 to be 320 feet farther northwest and applying declared distances to the runway. Also, minor grading work beyond the pavement edge would be required to meet RSA requirements. This action would ensure full compliance with FAA standards and provide for safer operations as RTS.

5.3.2 Taxiways

Full-length parallel taxiways in conjunction with adequate entrance and exit taxiways on a runway are necessary in order to obtain the highest level of airfield capacity. Currently, neither of the runways at RTS have dual full-length parallel taxiways. This section will explore development plans for taxiways at RTS.

5.3.2.1 Parallel Taxiways

Currently, each runway at RTS has a full-parallel taxiway associated with it. Generally dual full-length parallel taxiways are constructed when aviation development at an airport warrants the action. Although activity at RTS does not currently identify a need for dual full-length parallel taxiways, it is recommended that RTS continue to plan for their implementation. Additional parallel taxiways will help to increase capacity, provide for a safer airfield environment, and enable aviation related development in areas currently inaccessible by aircraft. Existing and future parallel taxiways should be planned and constructed to the same design criteria for the runways they are intended to serve. Being the ultimate Airport Reference Code (ARC) for each runway is C-III, taxiways should also be designed to that standard.

5.3.2.2 Rehabilitation of Taxiway D

Taxiway D at RTS is located on the west side of the airport and runs north and south connecting the NVANG apron area with the approach end of Runway 8. Currently this taxiway is designed to Group II standards and has a weight bearing capacity of only 12,500 pounds (Single Wheel Gear). This taxiway is recommended to be widened and strengthened to comply with Group III standards. This taxiway, once rehabilitated, will enable the development of hangars or other aviation uses both east and west of the taxiway, thereby providing the next logical location to expand aviation development once the areas along the southern property line are built out.

5.3.2.3 Rehabilitation of Closed Taxiway

The closed taxiway connecting the north end of Taxiway D with Taxiway C is recommended for rehabilitation. When operational, this taxiway will connect all areas of the airport more efficiently and create valuable airfield frontage for future development. This taxiway is recommended to be widened and strengthened to comply with Group III standards.

5.3.2.4 Connector Taxiways

As with parallel taxiways, connector taxiways are instrumental in allowing aircraft to exit the runway, thereby enhancing operational safety, reducing delay, and increasing overall capacity. A connector taxiway is one that links a runway to a parallel taxiway or other airside facility such as an aircraft parking apron. Guidance provided in the FAA Advisory

Circular (AC) 150/5060-5, *Airport Capacity and Delay*, recommends that a runway be equipped with a minimum of four connector taxiways, spaced at least 750 feet apart and located 2,000 to 4,000 feet from the landing thresholds, to maximize airport capacity.

The sizes, location and amounts of connector taxiways at RTS are currently sufficient. After runway improvements are completed at RTS, the connector taxiway system will continue to support a high airport capacity through adequately spaced entrances and exits to and from RTS's runway system.

5.3.3 NAVIGATIONAL AIDS

The available instrument approaches and navigational aids (NAVAIDS) at an airport have a measurable impact on overall airfield capacity, especially when considering hourly capacity under instrument meteorological conditions (IMC).

Based on a review of the existing NAVAIDS at RTS and the forecast of aviation demand, specific additions to the existing NAVAIDS and approach systems have been identified. Most notable is the implementation of an instrument landing system (ILS) approach to Runway 26. The need for an ILS on Runway 32 was previously recognized and a fully operational system has been installed by the FAA. Airspace constraints will prevent the ability to provide current technology precision instrument approach capabilities to Runway 8 and traffic does not warrant a precision instrument approach to Runway 14. However, maintaining the ability to have non-precision instrument approaches to those runways in the future as technology evolves will enhance IFR capabilities to the runways. A new ILS instrument approach to Runway 26 installed in the near term would further enhance the airfield's overall capacity during IMC. Although, GPS based precision approach systems have been growing in popularity in recent years, it is still a new and evolving technology. Planning for an ILS to the runway will preserve adequate land for any future NAVAID supporting precision approaches. Considering the limited level ground that exist beyond the Runway 26 end and the sharp elevation change, the airport should consider which approach lighting system (ALS) could provide the lowest minimums while limiting the cost associated with the ALS. Omni-Directional Approach Light System (ODALS) or Sequencing Flashing Lights (SFL) may prove to be the best solution for an ALS to complement the proposed ILS on Runway 26.

Table 5-1 shows the NAVAID requirements, according to runway, that are necessary to increase overall airport capacity and ensure operational safety during IMC. These requirements will complement the proposed runway and taxiway improvements discussed previously, to obtain the highest level of capacity.

Table 5-1. RTS NAVAIDS

Runway	Existing NAVAIDS	Proposed NAVAIDS
8	PAPI-4	Non-Precision – (ILS Backcourse, GPS and/or RNAV)
26	PAPI-4	Precision – (ILS, MALSR/ODALS/SFL)
14	PAPI-4	Non-Precision – (ILS Backcourse, GPS and/or RNAV)
32	PAPI-4, GPS, MALSR, ILS	

Source: PBS&J, 2009.

5.4 LANDSIDE ELEMENTS

Landside elements of an airport are generally those areas reserved for aircraft parking or storage, terminal facilities, vehicle parking areas, and other supporting areas not related to aircraft movements. This section will review those landside areas requiring improvement or expansion as recognized in Chapter 4.

5.4.1 Aircraft Storage Hangars

A strong demand for aircraft hangars was identified in Section 4.7 Aircraft Hangars which revealed that 114 additional hangar units are expected to be required in 2030. Recently, new taxilanes were developed on the west side of the airport to facilitate the addition of 60 conventional hangars, which are expected to be built within the next one to three years. This development is expected to meet the hangar demand through 2015.

After discussions with RTAA staff and analysis of various locations for future GA hangar development, a preferred location has been selected. The area immediately past and/or west of the current hangar development is considered the best location for the additional 54 hangars determined to be required by 2030. Since civil infrastructure such as roads and utilities already exist on the south side of the airport and based GA aircraft are found predominantly in the southwest corner, this location proved to be the most appropriate for hangar development.

5.4.2 Aircraft Aprons

The single large 215,000 square yard general aviation apron at RTS is used by both based and itinerant aircraft. This apron is considered to be more than adequate to meet traffic demand through 2030; however, the allocation of space should be revised. The forecast shows a strong growth in itinerant traffic, and Section 4.6 Aircraft Aprons and Tie-Downs revealed that double the existing itinerant tie down spaces will be needed by 2030. At present, roughly 33,000 square yards of apron is reserved for itinerant aircraft, but 65,000 square yards will be required by 2030 to allow for 181 itinerant aircraft. Itinerant aircraft parking area should be increased by adding additional stripping and grommets, as needed to meet the forecast demand. Considering the BLM leased area on the apron's east edge, additional tie down markings and hardware should be added to the west of the existing itinerant apron.

5.4.3 General Aviation Terminal Building

The existing terminal facility at RTS is only 1,700 square feet (not including airport administration offices) and considered significantly undersized when considering peak hour passenger levels over the planning period. Analysis from Section 4.9 Terminal Building and FBO identified that an appropriate size for the RTS terminal building would be roughly 10,000 square feet. The existing terminal building cannot be expanded but is in a good location. Therefore, the current terminal facility should be replaced with a larger one in the same general area. In addition, Table 4-18 of this report identified approximately 104 parking spaces will be required by 2030. Development of a general aviation terminal building should include a parking area of approximately this size.

5.4.4 Air Traffic Control Tower

Section 4.14 Air Traffic Control Tower (ATCT) highlighted the eligibility of RTS to enter into the federal contract tower program. This section of the development chapter is intended to offer preliminary guidance for the most appropriate location and height of a new ATCT including examining the adequacy of the existing tower's location and height. The analysis is based on FAA guidelines and recognizes existing and planned

development at the airport. The ATCT height and site selection considers the guidance set forth in FAA Order 6480.4A, *Airport Traffic Control Tower Siting Process*.

Based on the detailed ATCT Siting Analysis contained in **Appendix D**, the new ATCT should be located on the southeast side of the airport near the existing large FBO hangars and BLM operations area. The siting analysis analyzed nine different sites for development of a control tower through the use of a line-of-sight analysis. Furthermore, sites were scored based on 17 factors including: visibility of airborne and ground traffic, northern views to the primary movement areas, site area, and cost. The top scoring three sites (represented by site G, site C, and site F in Appendix E) were all located in this area of the airport as it provides the best-unobstructed vantage point for air traffic controllers at the lowest possible height. A more detailed siting study, in collaboration with the FAA, will need to be completed to identify the ultimate preferred location and height of this new facility.

5.4.5 Aviation Needs Summary

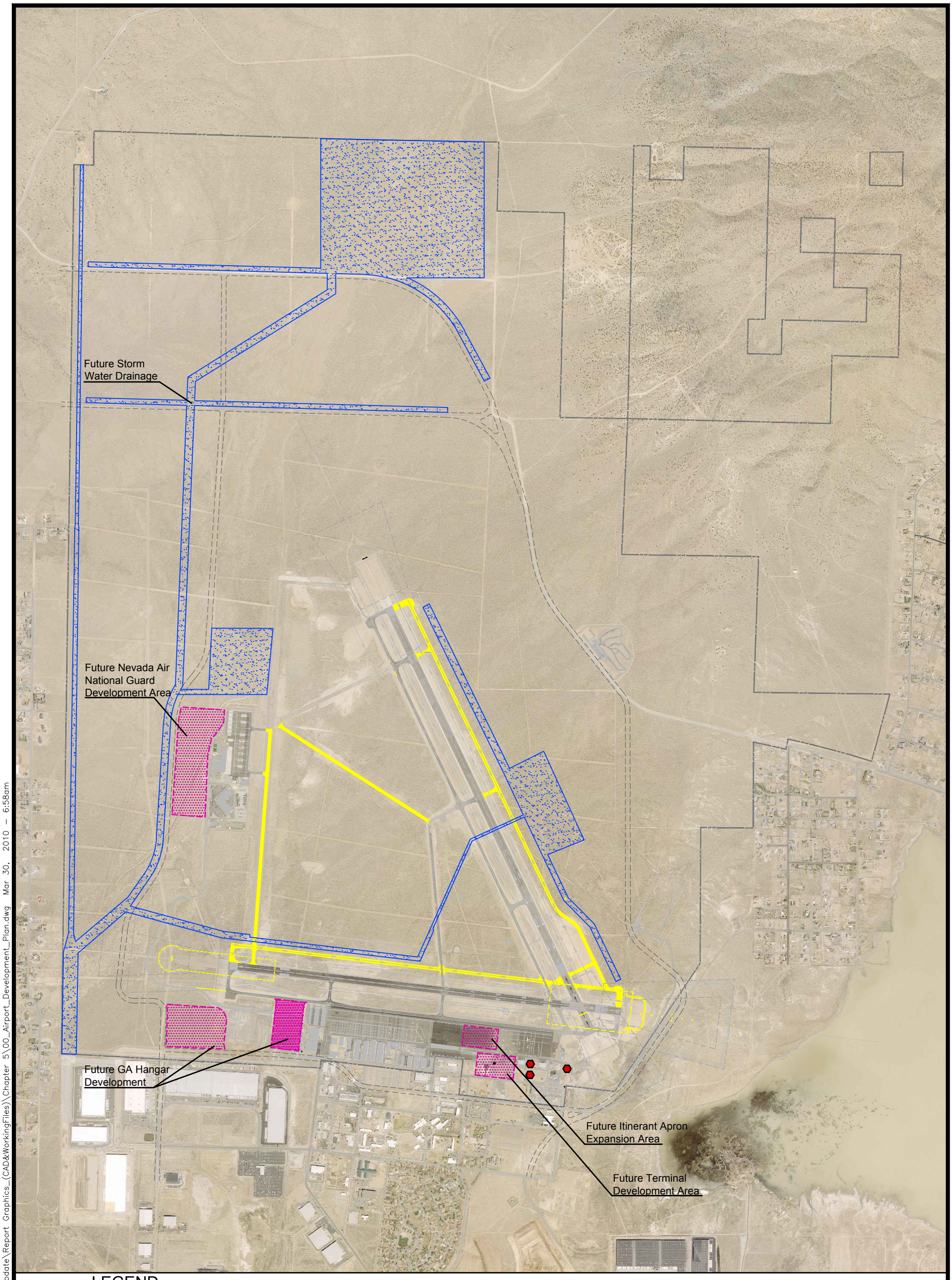
Based on the airside and landside elements discussed previously, a preferred airport development plan was created. The airport development plan provides expansion initiatives that most effectively meet the overall short, medium, and long-range aviation related requirements of RTS, in a manner which preserves a substantial amount of available land on-airport for future non-aviation development, while significantly enhancing operations safety and increasing the airfield efficiency and overall capacity at RTS. **Figure 5-1** illustrates the proposed airfield and landside improvements. It must be noted that although the determination of future military facility requirements were not part of this study, space to allow for future expansion of the NVANG was provided.

5.5 DEVELOPMENT PLAN

Airport land areas for aviation use are well defined by previous and proposed development and are those areas which offer direct access to the airfield area. However, at RTS the majority of airport property is not intended to be used for aviation purposes as most of the airport's land does not currently have or is expected to have airfield access. Maintaining adequate aviation use areas while maximizing non-aviation use areas ensures the airport can capitalize on the entirety of its land that is suitable for development. This section discusses the two genres of airport land use (aviation and non-aviation use) and the methodology for their creation at RTS. This section also discusses the two land use concepts, constrained and unconstrained. The constrained concept depicts the impact of the Reno Air Racing Association (RARA) National Championship Air Races and Air Show course safety areas, while the unconstrained concept provides for development of the airport in the event that RARA National Championship Air Races and Air Show safety areas no longer exist.

5.5.1 Aviation Use Areas

The aviation use areas are predominantly found directly adjacent to the airfield area, as shown on **Figure 5-2**. Specifically, aviation use areas are found north and south of Runway 8-26 and east and west of Runway 14-32, as well as on either side of all interior taxiways. In most cases the aviation use area is offset 1,000 feet from the airfield areas. This setback ensures adequate land is available for not only aviation related development but also for publicly accessible landside components (offices, display areas, parking, landscaping, etc.).



LEGEND

- Airside Improvements
- Landside Improvements
- Stormwater Management
- Preferred Air Traffic Control Tower Areas

0 1,750' 3,500'

NORTH

PBS&J

Reno-Stead Airport
Reno, Nevada

Airport Development Plan

Figure
5-1

J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 5\00_Airport_Development_Plan.dwg Mar 30, 2010 - 6:58am

0 1,750' 3,500'

NORTH

LEGEND

- Airfield (662 Acres)
- Airfield Easement (79 Acres)
- Aviation Use (881 Acres)
- Non-Aviation Use (2,982 Acres)
- Airfield Improvements
- Buffer Space (127 Acres)
- Stormwater Management (420 Acres)
- NVANG Expansion Area

PBS&J

Reno-Tahoe Airport Authority
P.O. Box 12490
Reno, Nevada 89510
Phone: 775-328-6400
Fax: 775-328-6510

Master Plan Update
Reno-Stead Airport
Reno, Nevada

General Development Plan

Figure 5-2

Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 5\00_LanduseAreas.dwg Mar30,2010 - 10:58am

The aviation use development plan identifies areas labeled generally as aviation use and includes the following types of aviation related development:

- Terminal Building and associated automobile parking
- Itinerant Apron
- Light GA hangars and facilities
- Corporate GA hangars and facilities
- Industrial Aviation
- Cargo Operations
- ATCT

5.5.2 Non-Aviation Areas

Recognizing the value of real estate within and adjacent to airport property that is not needed for aviation use, RTS has an opportunity to capitalize on its development potential enabling the airport to diversify revenue sources and utilize land to the fullest extent possible. Development of business centers, industrial parks, and commerce areas can be extremely valuable resources in the realization of that goal. Careful planning and organization of these non-aviation revenue generators can be vital to the financial independence of the airport and funding of either landside or airside improvements of the airport. The non-aviation areas are identified on Figure 5-2.

5.5.3 Unconstrained Land Use Concept

The unconstrained land use concept was developed with the understanding that there are no factors limiting the land use potential for any land within the confines of the Reno-Stead Airport property. In addition, this concept assumes all lands are available for development and that those areas could be developed at anytime in the future, including beyond the 20-year planning horizon. A graphical depiction of the unconstrained land use concept for RTS is found on **Figure 5-3**.

5.5.4 Constrained Land Use Concept

The constrained land use concept was developed with an understanding that RTS continues to host the annual National Championship Air Races and Air Show, and that areas underneath the RARA National Championship Air Races and Air Show safety areas are not suitable for development. This land use concept limits the land available for both aviation and non-aviation development, while ensuring adequate clear areas for the National Championship Air Races and Air Show courses. This land use concept provides a good starting point for identifying the location of near-term development at the airport or development which occurs while RTS hosts the National Championship Air Races and Air Show. Considering that the development of RTS property will occur over time, and that not all areas will be developed at once, this land use concept could also be viewed as a Phase I concept which ultimately develops into the unconstrained land use concept. A graphical depiction of the constrained land use concept for RTS is found on **Figure 5-4**.

235 Acres
10 Acres
6 Acres
6 Acres
33 Acres
129 Acres
186 Acres
5 Acres
5 Acres
6 Acres
6 Acres
9 Acres
15 Acres
15 Acres
555 Acres
648 Acres
414 Acres
9 Acres
46 Acres
10 Acres
376 Acres
NVANG Expansion Area
33 Acres
166 Acres
104 Acres
13 Acres
12 Acres
4 Acres
54 Acres
201 Acres
14 Acres
25 Acres
117 Acres
32 Acres
56 Acres
4.5 Acres
662 Acres
62 Acres
219 Acres
53 Acres
26 Acres

0 1,750' 3,500'

NORTH

LEGEND

- Airfield (662 Acres)
- Airfield Easement (79 Acres)
- Aviation Use (881 Acres)
- Industrial/Commercial (2,360 Acres)
- Airfield Improvements
- Buffer Space (127 Acres)
- Retail (199 Acres)
- Rural Residential (423 Acres)
- Stormwater Management (420 Acres)

PBS&J

Reno-Tahoe Airport Authority
P.O. Box 12490
Reno, Nevada 89510
Phone: 775-328-6400
Fax: 775-328-6510

Master Plan Update
Reno-Stead Airport
Reno, Nevada

Conceptual On-Airport Development Plan Unconstrained

Figure 5-3

Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 5\00_Landuse_Unconstrained.dwg Mar30,2010 - 11:03am

12 Acres
9 Acres
69 Acres
10 Acres
6 Acres
84 Acres
254 Acres
19 Acres
6 Acres
70 Acres
119 Acres
9 Acres
1.5 Acres
1 Acre
5 Acres
30 Acres
6 Acres
370 Acres
RARA Safety Area
13.5 Acres
14 Acres
10 Acres
54 Acres
122 Acres
33.5 Acres
47 Acres
0.5 Acres
21.5 Acres
2.5 Acres
32 Acres
7 Acres
176 Acres
5.5 Acres
28 Acres
63.5 Acres
41.5 Acres
NVANC Expansion Area
3.3 Acres
14.5 Acres
5 Acres
0.5 Acres
32 Acres
94.5 Acres
17 Acres
3.5 Acres
14 Acres
.5 Acres
6 Acres
2 Acres
62.5 Acres
53 Acres
662 Acres
219 Acres
26 Acres

0 1,750' 3,500'

NORTH

LEGEND

- Airfield (662 Acres)
- Airfield Easement (79 Acres)
- Aviation Use (648 Acres)
- Industrial/Commercial (1,191 Acres)
- Airfield Improvements
- Buffer Space (127 Acres)
- Retail (123 Acres)
- Rural Residential (264 Acres)
- Stormwater Management (420 Acres)

PBS&J

Reno-Tahoe Airport Authority
P.O. Box 12490
Reno, Nevada 89510
Phone: 775-328-6400
Fax: 775-328-6510

Master Plan Update
Reno-Stead Airport
Reno, Nevada

Conceptual On-Airport Development Plan Constrained

Figure 5-4

Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 5\00_Landuse_Constrained.dwg Mar30,2010 - 11:21am

5.6 SUMMARY

The development plan represents the chosen configuration of the necessary development and facility improvements that will not only meet the forecast demand but also ultimately ensure competitiveness and financial viability for RTS. Additionally, this development plan is intended to provide RTS and surrounding community with the greatest overall benefit considering the development goals of RTAA.

DRAINAGE MASTER PLAN

Reno-Stead Airport

6

6.1 INTRODUCTION & PURPOSE

The Reno–Stead Airport (RTS) is located in northwest Reno, east of U.S. Highway 395 (**Figure 6-1**). The hydrologic watershed impacting the project area is located within Washoe County and City of Reno (**Figure 6-2**).

The purpose of this drainage master plan is to serve as a guide for development of RTS property. This drainage master plan identifies location, alignment, and preliminary size of storm water control facilities on airport property which will protect aviation structures from flooding and mitigate downstream hydrologic impacts of future development of airport property. Storm water runoff control facilities are sized based on future watershed conditions which assume full build-out of the airport property (**Figure 6-3**). RTS is the current home of the National Championship Reno Air Races and Air Show which is an event held annually. The land beneath the race courses (constrained areas) cannot currently be developed due to safety concerns. This drainage master plan has attempted to locate drainage facilities within the constrained areas where possible to avoid using land currently available for development.

6.2 PROCEDURES & CRITERIA

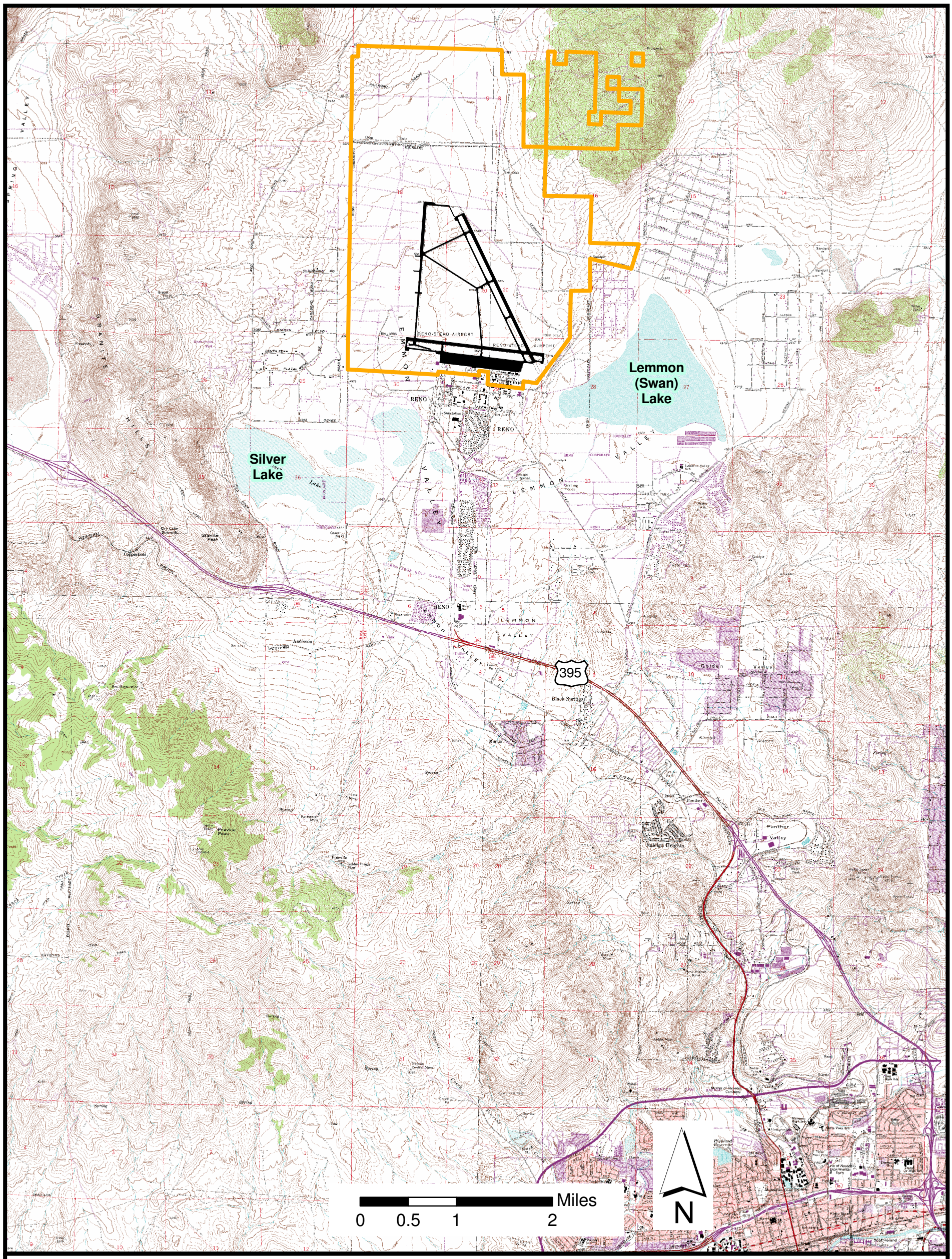
6.2.1 Previous Studies

The following studies identified in **Table 6-1** contain the most recent prior analyses of storm water drainage in the Silver Lake and Swan or Lemmon Lake watersheds which were used in this effort.

Table 6-1. Previous Drainage Reports

Year	Report Title	Description
2007	North Valleys Flood Control Hydrologic Analysis and Mitigation Options Reno, Nevada Volumes I and II	This report summarizes the existing watershed conditions for Silver and Swan Lakes, discusses current Federal Emergency Management Agency (FEMA) flood zones and the impact of future development on current FEMA flood zones, and develops various alternatives to mitigate impacts of future development on Silver and Swan Lake watersheds.
2000	Drainage Master Plan, Stead, Nevada	This study developed 5-year and 100-year, 24-hour Flood Hydrograph Package (HEC-1) models for Silver and Swan Lake watersheds.

The North Valleys Flood Control Hydrologic Analysis (NVFCHA) HEC-1 files were obtained from the City of Reno and used as base models for Silver and Swan Lake watersheds in this analysis.

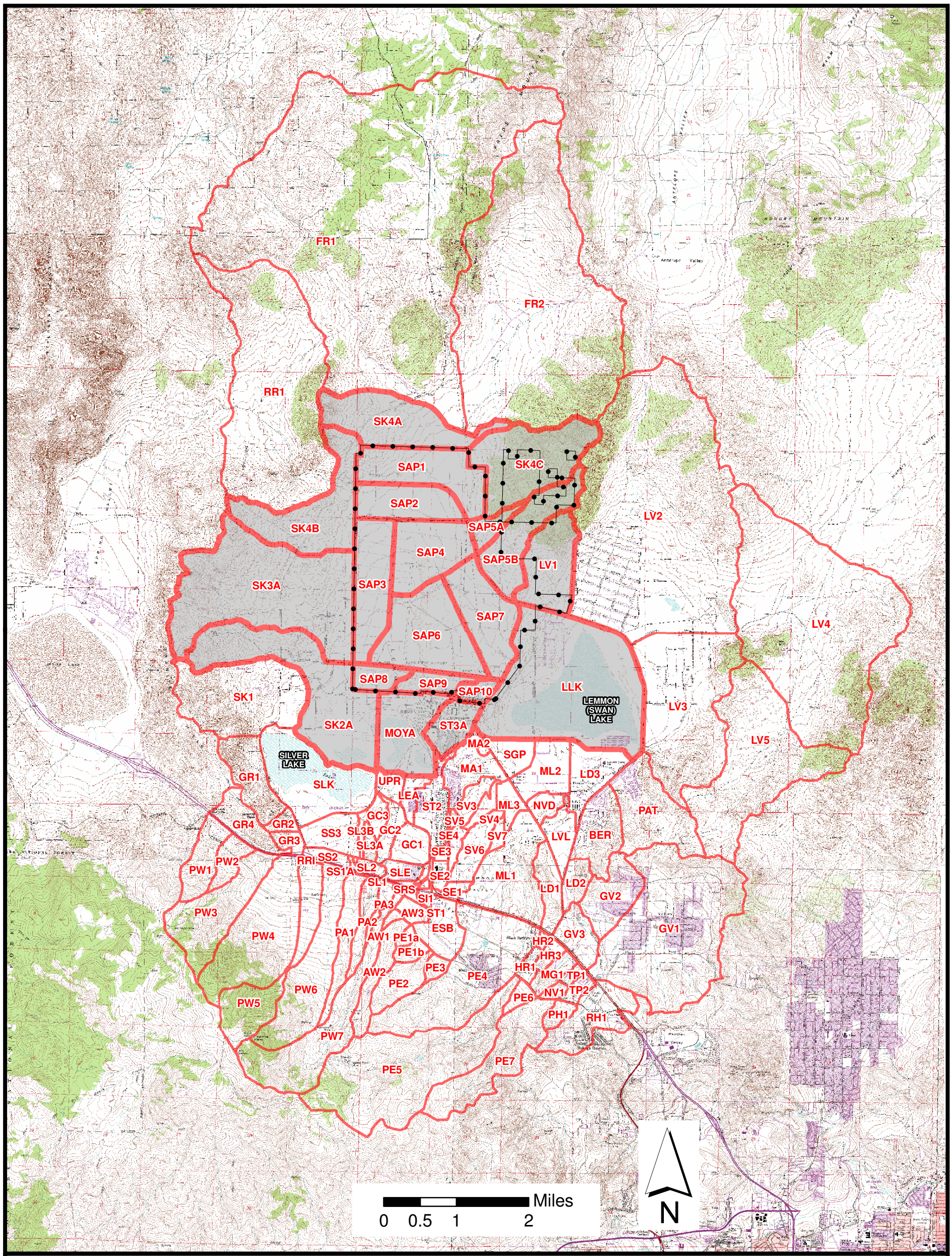


Legend

Airport Property

existing

PBSJ	Reno-Stead Airport Reno, Nevada	Area / Vicinity Map Map	FIGURE 6-1



Legend

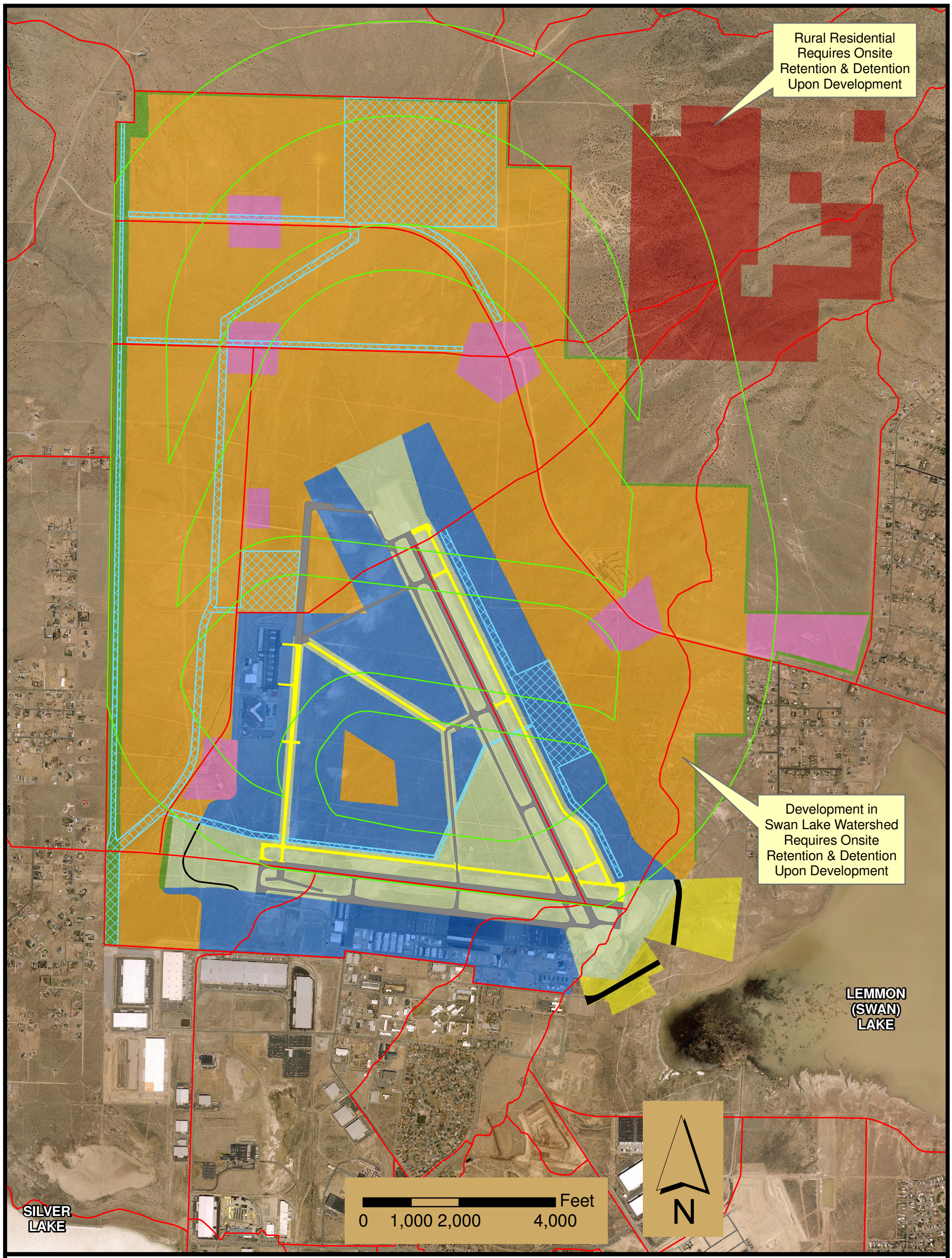
Airport Property

Watershed Boundaries

Prior Study Sub-basin

Revised Sub-basin

PBSJ	Reno - Stead Airport Reno, Nevada	Overall Watershed Map	FIGURE 6-2



Legend

- RARA Constrained Areas
- Watershed Boundaries
- Drainage Improvements
- Existing Pavement
- Proposed Pavement
- Airfield Improvements
- Aviation Use
- Industrial/Commercial
- Retail
- Airfield
- Airfield Easement
- Buffer Space
- Rural Residential

PBSJ	Reno - Stead Airport Reno, Nevada	Proposed Condition Land Use Map	FIGURE 6-3

6.2.2 Compliance with the Truckee Meadows Regional Drainage Manual

Since RTS is located within a closed hydrographic basin, control of storm water runoff as a result of future development is a critically important issue due to the potential adverse impacts created downstream. Development at RTS must comply with Washoe County, City of Reno and Section 709.2 of the Truckee Meadow Regional Drainage Manual (TMRDM) which states that:

> *Runoff from within the Silver Lake and Swan Lake (aka Lemmon Lake) hydrographic basins will ultimately discharge to the Silver Lake Playa or the Swan Lake Playa, respectively. A detailed hydrologic analysis and resultant water surface elevation (in the playa) produced by the 1% chance precipitation event was the subject of a detailed study performed by Quad Knopf (Refer to: North Valleys Flood Control Hydrologic Analysis and Mitigation Options, Volumes I and II; Quad Knopf, March 30, 2007, prepared for the Washoe County Regional Water Planning Commission and the City of Reno). This study shows that any increases in runoff volume due to development (or loss of flood plain storage due to development) will impact the FEMA regulated water surface elevation in the playas. Future development shall account for the increased volume of runoff generated (within the basin), as well as for flood plain storage volumes within the 100-year flood plain. Development within these basins shall require a hydrology report identifying required mitigation, if any, to maintain the water surface elevations within the playas for the 1% chance event (no net increase allowed). Volumetric analysis is to be based on the 100-year, 10-day storm event, while routing of peak flows shall be based on the 100-year, 24-hour storm event. See Reno Municipal Code 18.12.1703(g) and Washoe County Development Code Article 416 for restrictions on closed basins. Due to zoning overlays which regulate the proximity of structures and land uses adjacent to the White Lake Playa (Cold Springs Area)…*

The hydrologic analysis completed for and the preferred solution identified for this master plan shows that the future watershed condition 100-year, 24-hour peak flows downstream of the airport property will not exceed the existing watershed condition flow rates. Future on-site flows increase due to additional impervious surface created by development, and these flows are reduced to existing flow rates by the recommended solution. The preferred drainage alternative and two discarded alternatives are discussed in Section 6.3.

6.2.3 Hydrologic Procedures

Sub-basins used in the NVFCHA study were imported into a Geographic Information System (GIS) for the RTS Master Plan Update (Master Plan) development plan and sub-divided to create hydrologic (HEC-1) concentration points within the airport property and to develop multiple basins of similar hydrologic characteristics. Sub-basins were divided based on a combination of topographical information and planned roadway locations.

Two storm durations were used for the drainage master plan to satisfy the requirements of the TMRDM: a 100-year, 24-hour event to determine peak flows and a 100-year, 10-day event to determine runoff volume. The 100-year design storm is a storm event that has a one percent chance of occurring in any given year. HEC-1 Version 4.1 (dated June 1998) was used for the hydrologic modeling. The existing watershed condition 100-year, 24-hour model (Ex-24hr.Dat) developed for the drainage master plan was based on existing condition land use and vegetation cover as outlined in the NVFCHA. The

watershed in the NVFCHA model (SLV-SWN_NEWCOV_100_10_2005.DAT) was subdivided to add sub-basins SAP1 through SAP10 (**Figure 6-4**) on the airport property. Sub-basin routing lengths were recomputed. The remaining hydrologic parameters were unchanged from the NVFCHA. The proposed watershed condition 100-year, 24-hour HEC-1 model (Prop-24hr.Dat) was developed by changing the land uses and routing parameters of the existing condition model to reflect planned land uses and drainage patterns for the fully developed or unconstrained condition. **Figure 6-5** shows the proposed condition HEC-1 sub-basins and routing reaches. All HEC-1 models are included in **Appendices E-1 and E-2**.

6.2.3.1 Precipitation

National Oceanic and Atmospheric Administration (NOAA) 14 values were used in the NVFCHA study and input into the HEC-1 model to develop the 100-year, 24-hour design storm. These same inputs were used for this master plan. Point precipitation values are adjusted by applying Depth Area Reduction Factors (DARF). The DARF decreases the point rainfall values to represent an average depth of rainfall over the entire storm area, the larger the storm area the lower the average rainfall. Each DARF ratio is for a specific storm size or tributary area. Hydrologic models were run with several DARF ratios. DARF values used in the previous NVFCHA study were used for the 100-Year, 24-Hour HEC-1 models in this drainage master plan. These values were interpolated from Figure 605 of the TMRDM.

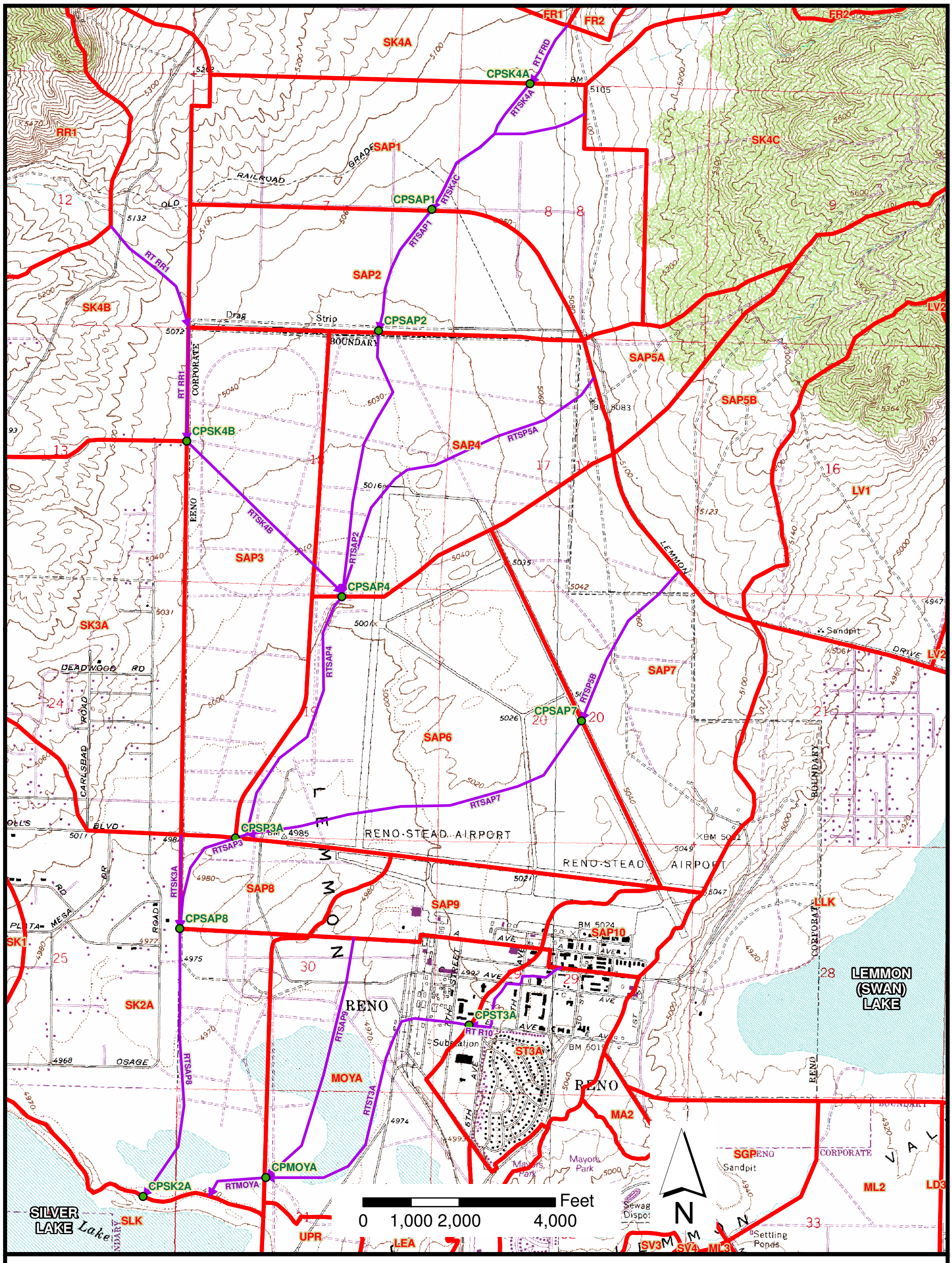
6.2.3.2 Curve Number

Soil classification information was derived from the United States Department of Agriculture/Natural Resources Conservation Service (USDA/NRCS) web soil survey and the Soil Survey of Washoe County, South Part. Hydrologic Soil Groups were determined from the web survey for use in the curve number (CN) calculations and are illustrated in **Figure 6-6**. The web soil survey information used in the analysis is located in Appendix E-1. Additionally, vegetation coverage (noted in the NVFCHA study), the proposed development plan (shown in Figure 6-3) and Table 702 of the TMRDM were all used to determine CNs. **Table 6-2** provides a summary of the proposed CNs used for the proposed condition modeling.

Table 6-2. 100-Year, 24-Hour Land Use Summary

Land Use	Curve Numbers				Additional % Impervious
	A	B	C	D	
Aviation Use	89	92	94	95	5
Industrial/Commercial	81	88	91	93	0
Retail	89	92	94	95	0
Airfield	35	49	61	68	Varies
Buffer Space	Based on Ex. Cond. Zones				0

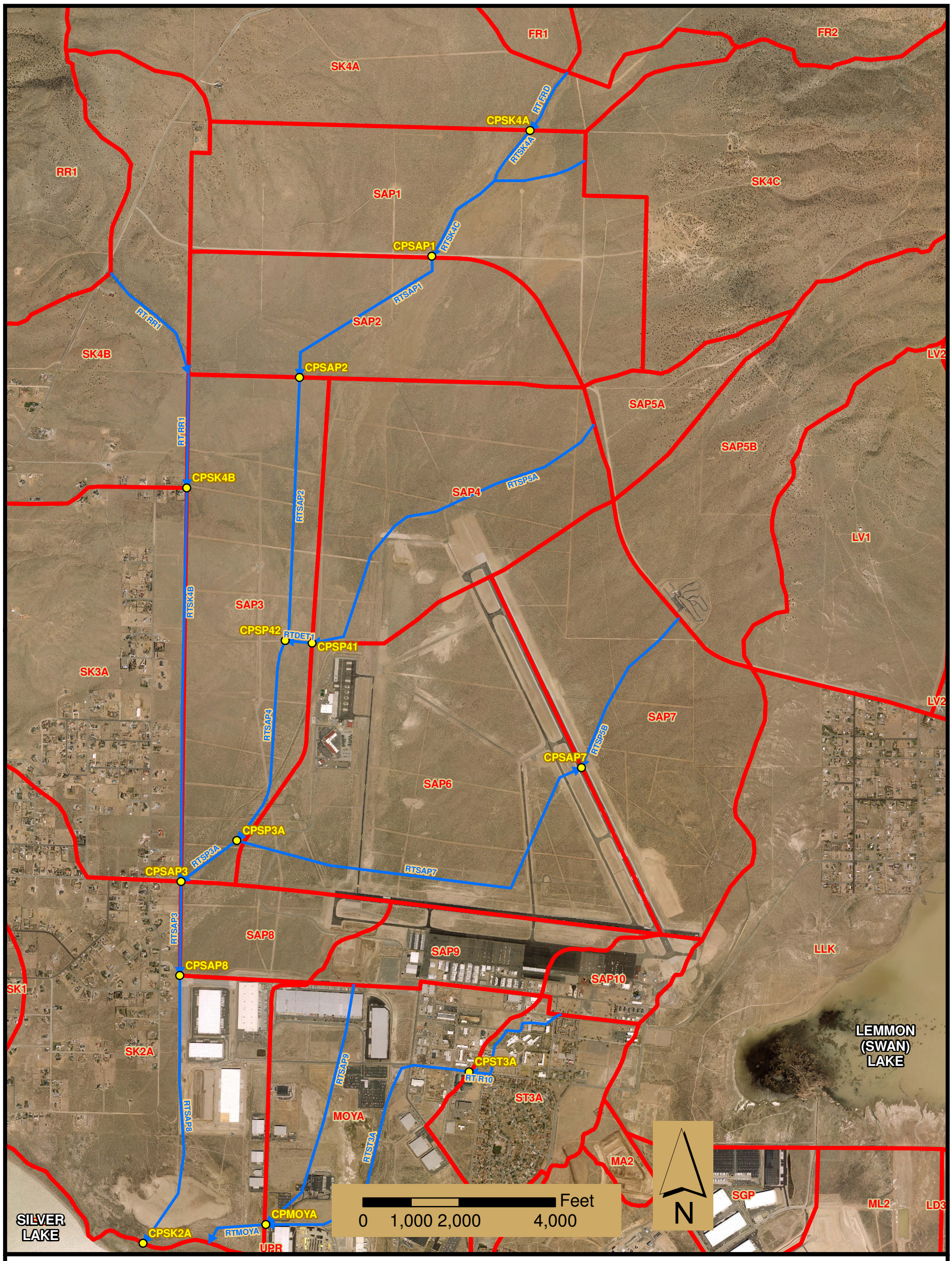
Sub-basins outside the airport property were modeled as they were in the NVFCHA study, however, the CNs were adjusted back from the 10-day runoff event back to 24-hour CNs, using Table 2-3 from TR-60, Earth Dams and Reservoirs.



Legend

- HEC-1 Concentration Pt.
- Routing Reach
- Watershed Boundaries

PBSJ	Reno - Stead Airport Reno, Nevada	Existing Condition Watershed Map	FIGURE 6-4

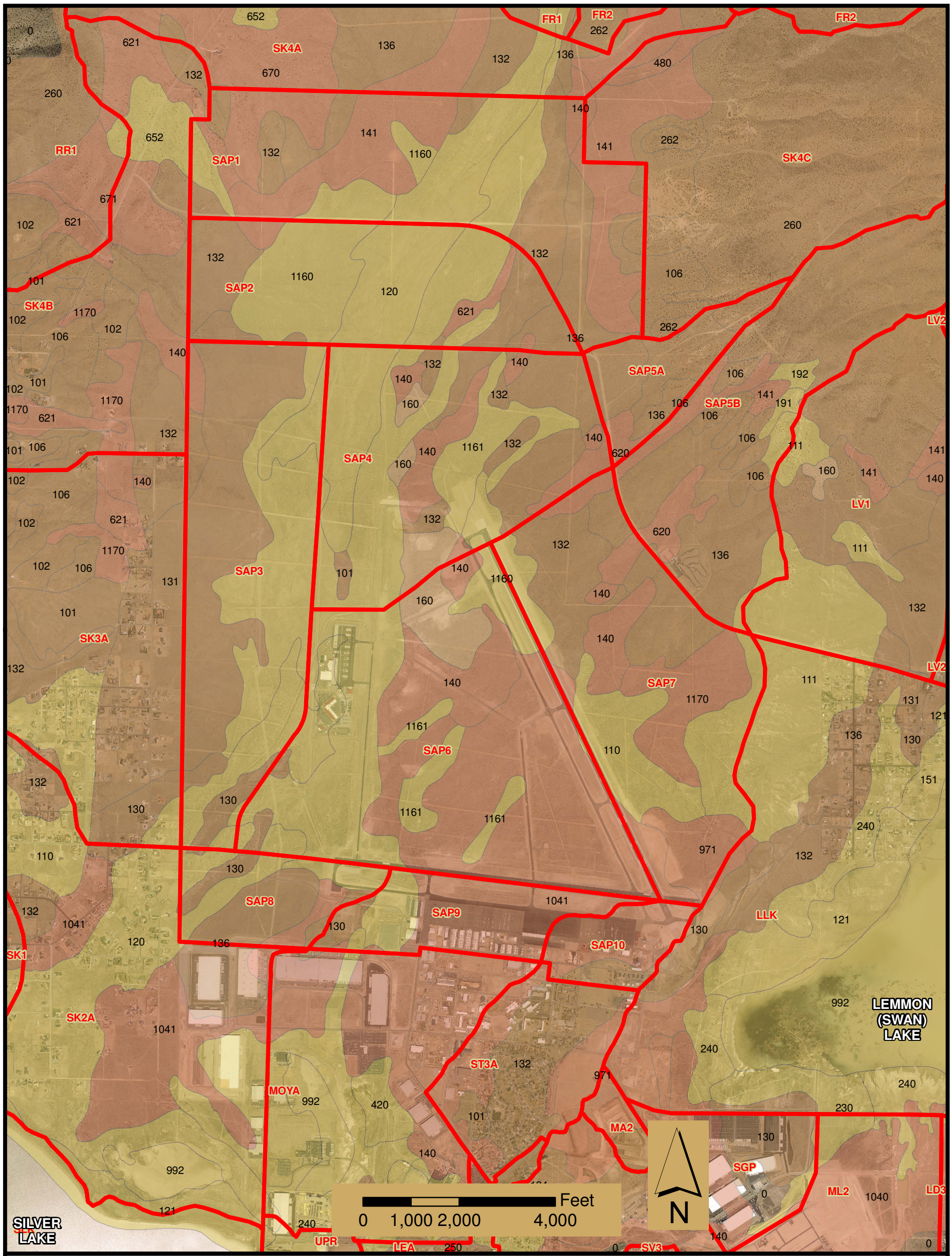


Legend

HEC-1 Concentration Pt. — Routing Reach

Watershed Boundaries

PBSJ	Reno - Stead Airport Reno, Nevada	Proposed Condition Watershed Map	FIGURE 6-5



Legend

Watershed Boundaries

Hydrologic Soil Group

B D A C

PBSJ	Reno - Stead Airport Reno, Nevada	Soils Map	FIGURE 6-6

6.2.3.3 Lag Time

Lag times (TLAG) were determined for each sub-basin within the airport property based on equations 709 and 710 of Section 705.3 of the TMRDM. Existing watershed condition lag times were based on undeveloped CN values and velocities. Lag times for the developed watershed condition were based on full build-out CN values and velocities from impervious surfaces. Lag times for sub-basins smaller than 1 square mile and with slopes less than 10 percent were calculated based on TLAG = $0.6T_c/60$. Lag times for sub-basins larger than 1 square mile or with slopes greater than 10 percent were calculated based on the United States Bureau of Reclamation equation, TLAG = $22.1Kn(L\ L_c/S^{0.5})^{0.33}$. Lag times for sub-basins LV1 and LLK were used from the NVFCHA. Lag time calculations are included on the Standard Form 2 in Appendix E-1.

6.2.4 Hydraulic Procedures

Culvert capacities were estimated using the U.S. Department of Transportation, Federal Highway Administration Hydraulic Design Series Number 5 (Hydraulic Design of Highway Culverts) Charts 1B and 8B. These inlet control charts estimate culvert capacity based on available headwater and assume inlet control for the 100-year, 24-hour flow. Proposed channels were sized using Bentley's FlowMaster software which uses Manning's equation to estimate a normal depth for the 100-year, 24-hour flow.

6.3 HYDROLOGIC ANALYSIS

The RTS property drains to two closed basins, Silver Lake and Swan Lake. As described in Section 6.2.2, the TMRDM requires the hydrologic master plan for the airport property to analyze the 100-year, 24-hour storm event and the 100-year, 10-day storm event to ensure no adverse impact to the surrounding areas. Section 709.2 of the TMRDM cites the NVFCHA as the source for current water surface elevation produced by the one percent chance precipitation event and shows that any increases in runoff volume from development within the watershed will likely impact the FEMA regulated water surface elevations in the Silver Lake and Swan Lake playa areas (Appendix E-2). The RTS property does not extend into the FEMA 100-year flood plains, however any increase in 100-year runoff (peak and volume) from future development planned within the airport property could affect the FEMA 100-year flood plain level. This drainage master plan incorporates planned future land uses to determine the potential impacts from future development and has identified several major drainage improvements that are needed to mitigate the increased 100-year, 10-day storm runoff volumes, and the increased 100-year, 24-hour storm peak flows. The following hydrologic analysis is intended to show that the proposed drainage improvements will fully mitigate the hydrologic impacts of future development of airport property (Figure 6-3) and the 100-year water surface elevations of Silver Lake and Swan Lake playas will not be increased. **Table 6-3** summarizes the main hydrologic models referenced and created for this drainage master plan.

Three alternatives were initially developed to a preliminary stage to determine the benefits and constraints of each (see **Table 6-4**). Based on the drainage alternatives workshop held with Reno Tahoe Airport Authority (RTAA) staff on April 4, 2009, Alternative 1 was determined to have substantial benefits versus constraints as compared to the other alternatives. **Appendix E-3** includes the workshop memorandum which provides a full description of the benefits and constraints of the discarded alternatives.

Alternative 1 utilizes one large (± 200 acres) retention area at the north end of the airport property to reduce 100-year, 10-day runoff volumes, and two smaller (± 40 acres each) detention facilities closer to the runways to reduce 100-year, 24-hour peak runoff rates. All three of these basins will be below finished grade so as not to require a dam safety permit. This alternative will be referred to as the proposed condition for the purpose of the master plan.

Table 6-3. Summary of HEC-1 Models

Author	HEC-1 Model	Description / Use
NVFCHA	SLV-SWN_NEWCOV_100_10_2005.DAT	Base model used for 100-year, 24-hour drainage master plan models.
PBS&J	Ex-24hr.DAT	Drainage master plan existing watershed condition model based on NVFCHA model with CNs converted to 24-hour CNs, rainfall reduced to 24-hours, 5 minute computation intervals, and sub-divided RTS sub-basins. Used to establish existing watershed condition for 100-year, 24-hour analysis.
PBS&J	Prop-24hr.DAT	Drainage master plan developed watershed condition model based on Ex-24hr.DAT with developed condition lag times, CNs, and routing reaches. Used to demonstrate retention and detention basin abilities to reduce 100-year, 24-hour peak flow increases from development of airport property.
NVFCHA	SLV_LUMP_NEWCOV_25_2005.DAT	Base model used for 100-year, 10-day drainage master plan models.
NVFCHA	SWN_LUMP_NEWCOV_25_2005.DAT	Base model used for 100-year, 10-day drainage master plan models.
PBS&J	Slv-lump-uc.DAT	Master plan developed watershed condition model based on NVFCHA model with updated percent imperviousness based on proposed land uses. Used to determine runoff volume increase to Silver Lake from future airport development.
PBS&J	Swn-lump-uc.DAT	Drainage master plan developed watershed condition model based on NVFCHA model with updated percent imperviousness based on proposed land uses. Used to determine runoff volume increase to Swan Lake from future airport development.
PBS&J	RETEN.DAT	Drainage master plan developed watershed condition model for retention basin located at the northern property boundary of the RTS. Used to demonstrate the proposed retention basin's infiltration potential.

Table 6-4. Alternatives Matrix

	Alternative 1	Alternative 2	Alternative 3
Army Guard operations – less likely to impact			X
Drainage improvement land possibly shared with Washoe Co.	X		
Drainage improvements located largely in constrained areas	X	X	
Impact to neighbors – less likely need for vector control	X		
Infiltration tests – less likely to impact lake levels	X		
Land development – less drainage burden on smaller parcels	X	X	
Land development – less impact to prime areas	X		X
Likely to avoid need for larger, impervious basins	X		
Maintenance – Ease of access	X	X	
Operational safety – potentially reduced bird strike risk	X		X
Probability of successful property drainage	X	X	
Temporary drainage – less likely to need substantial features	X		
Western Property 300 foot buffer - best utilization		X	
	Preferred Alternative	**Discarded**	**Discarded**

6.3.1 100-Year, 24-Hour Analysis

Existing drainage patterns within RTS generally drain from the northeast to the southwest (Figure 6-4). The undeveloped portion of the property is generally covered with a mix of sagebrush with grass understory. The vast majority of the property drains to Silver Lake. Only a small portion of the airport property located within sub-basins LV1 and LLK drain to Swan Lake. The proposed improvements perpetuate existing drainage patterns as can be seen in Figure 6-5. It was also assumed in the HEC-1 analysis that proposed development would not change the sub-basin boundaries between Silver and Swan Lakes.

NVFCHA HEC-1 model SLV-SWN_NEWCOV_100_10_2005.DAT was used as the base model for the 100-year, 24-hour modeling. This model was modified in the following ways for the master plan 100-year, 24-hour analysis:

- Sub-basins SK2 through SK4, MOY, and ST3 were subdivided into sub-basins SK4A through SK4C, SAP1 through SAP10, SK2A, and SK3A.
- Percent impervious coverage was increased for sub-basins LLK and LV1 to simulate future development.
- 10-day CN values were converted to 1-day CN values and reflected on the HEC-1 LS cards.
- The rainfall duration was reduced to 24 hours on the HEC-1 PH cards.

- The computation interval was reduced to 5 minutes to increase the accuracy of the calculated output.

Table 6-5 shows the results of the 100-year, 24-hour HEC-1 modeling. CPSK2A is used as the combination point at Silver Lake, and CP LLK is used for the combination point at Swan Lake. The table shows that the runoff from the proposed development is reduced from 3,532 cubic feet per second (cfs) to 3,530 cfs (reduction of two cfs) to Silver Lake. This reduction in runoff peak is due to the retention basin and two detention basins that have been included as a part of the master plan to the Silver Lake watershed. The Rural Residential parcel at the northeast corner of the property was not included in the regional analysis for Silver Lake. Prior to development, this parcel will have to incorporate onsite detention and retention to ensure no adverse impacts downstream. Runoff to Swan Lake is increased from 6,665 cfs to 6,862 cfs (increase of 197 cfs). No regional retention or detention options were analyzed for the Swan Lake watershed due to the limited amount of airport property within the watershed and the proximity to the lake. Prior to development of the parcels within sub-basins LV1 and LLK, the site design will have to incorporate onsite detention to prove that the 100-year, 24-hour peak flow is not increased to neighboring parcels and the 100-year, 10-day runoff volume is not increased as described in Section 6.3.2.

The proposed retention basin at the north end of the airport property will not only serve to reduce the 100-year, 10-day runoff volume as described in Section 6.3.2, it will also work in conjunction with the two detention basins to reduce peak flows during the 100-year, 24-hour event. Modeling of the retention basin for the 100-year, 24-hour event does not account for infiltration due to the shorter storm duration, however infiltration will occur during the event and further reduce downstream peak flows. Detention basin DETEN1 is located within sub-basin SAP4 and achieves a peak storage of 136 acre-feet. DETEN2 is located within sub-basin SAP7 and achieves a peak storage of 170 acre-feet. DETEN1 is conceptually modeled with a 36-inch reinforced concrete pipe (RCP) outlet fitted with a 5.5 square foot restrictor plate. This will allow the basin to fill within one foot of the spillway elevation, and drain 90 percent of its storage capacity within 48 hours after the event. DETEN2 is conceptually modeled with a 7-foot by 3-foot reinforced concrete box culvert (RCBC) outlet fitted with an 8.5 square foot restrictor plate. This will also allow the basin to maintain 1 foot of freeboard and drain 90 percent of its storage capacity within approximately 33 hours after the event.

These basins have been located as far from active runways as possible to reduce the threat of bird strikes. Draining the basins in a relatively short period will also reduce the bird strike threat as well as minimize any vector control issues. Attempts were made to relocate DETEN1 further from the Nevada Army National Guard, however moving the basin west of the Moya Road extension reduced its benefit due to the topography and the large amount of flow contributing from the northern sub-basins. There was concern that water within DETEN2 would cause reflection issues and interfere with the Instrument Landing System (ILS), however that risk should be minimized due to the depth of the basin below grade and the relatively short drain time. The assumption was made that both of the detention basins will be classified as regional detention basins under the guidelines of Section 1302.1 of the TMRDM. At the time of final design, sediment storage within or upstream of each basin should be provided for as described in Section 6.5.

Table 6-5. 100-Year, 24-Hour HEC-1 Summary

HEC-1 Node	Existing Q (cfs)	HEC-1 Node	Proposed Q (cfs)
CPSAP1	2,348	CPSAP1	2,352
CPSAP2	2,386	CPSAP2	1,129
CPSAP4	2,895	CPSP42	1,187
CPSP3A	3,127	CPSP3A	2,350
CPSAP8	3,325	CPSAP8	2,785
SAP9	108	SAP9	195
SAP10	94	SAP10	146
CPSK2A	3,532	CPSK2A	3,530
LV1	304	LV1	442
LLK	3,177	LLK	3,249
CP LLK	6,665	CP LLK	6,862

See Appendix E-1 for complete HEC-1 summary output.

6.3.2 100-Year, 10-Day Analysis

NVFCHA HEC-1 models SLV_LUMP_NEWCOV_25_2005.DAT and SWN_LUMP _NEWCOV_25_2005.DAT were used as representative of the existing condition 100-year, 10-day runoff volumes for Silver and Swan Lake respectively. These models were then modified to incorporate increased impervious surface area that would result from the development of the airport property. **Table 6-6** shows that by developing the airport property, approximately 2,356 acre-feet of added runoff volume would impact Silver Lake and 74 acre-feet of added runoff volume would impact Swan Lake. This added volume would raise the Silver Lake water surface elevation from 4971.74 to 4973.54 and the Swan Lake water surface elevation from 4922.94 to 4922.99. Therefore, to avoid impacting the 100-year water surface elevations of the lakes, an onsite retention basin was incorporated into the drainage master plan at the north end of the airport property to mitigate for this increased runoff volume.

Table 6-6. 100-Year, 10-Day HEC-1 Summary

HEC-1 Node	Existing Runoff Vol. (ac ft)	Proposed Runoff Vol. (ac ft)	Volume Increase (ac ft)
SILVER	7,210	9,566	2,356
SWAN	6,956	7,030	74

See Appendix E-2 for HEC-1 summary output.

The conceptual retention basin modeled for this drainage master plan is located at the northern property boundary of the airport and primarily receives flow from sub-basins FR1 and FR2. Results from retention basin model (RETEN.DAT, Appendix E-2) show that 2,390 acre-feet can be infiltrated in the retention basin, mitigating for the 2,356 acre-feet of increased runoff volume (not including the Rural Residential parcel) in the Silver

Lake watershed. The RETEN.DAT model has incorporated four pump cards to represent the amount of infiltration that is likely to take place during the 10-day event. These long term infiltration rates were determined from a series of pilot infiltration tests. This is the same calibrated methodology that was used in the NVFCHA study. The pumping rates (WP cards in HEC-1 model) were based on long term infiltration rates of 0.6 to 2.3 inch/hour (identified in the NVFCHA study for this location) at depths of 4 feet or less. Ponding depths within the retention basin are designed for a maximum of 7 feet (with one foot of freeboard) which with the increased head will likely infiltrate more than what was estimated in the HEC-1 model. In addition to the infiltration at the retention basin, it is anticipated that the detention basins will also infiltrate stormwater runoff, however this volume was not included in the analysis. Consequently, the resulting calculations are slightly conservative.

In the Swan Lake watershed, individual retention and detention sites will need to be completed with the development of each airport parcel. The small amount of airport property that is located within the Swan Lake watershed is very close to Swan Lake itself. This master plan assumes that any parcel within the Swan Lake watershed (sub-basins LV1 or LLK) will require detailed analysis at the time of design to ensure no adverse impact to the Swan Lake 100-year water surface elevation. This master plan has estimated that approximately 74 acre-feet of retention will be required on these parcels to mitigate this increase in runoff volume.

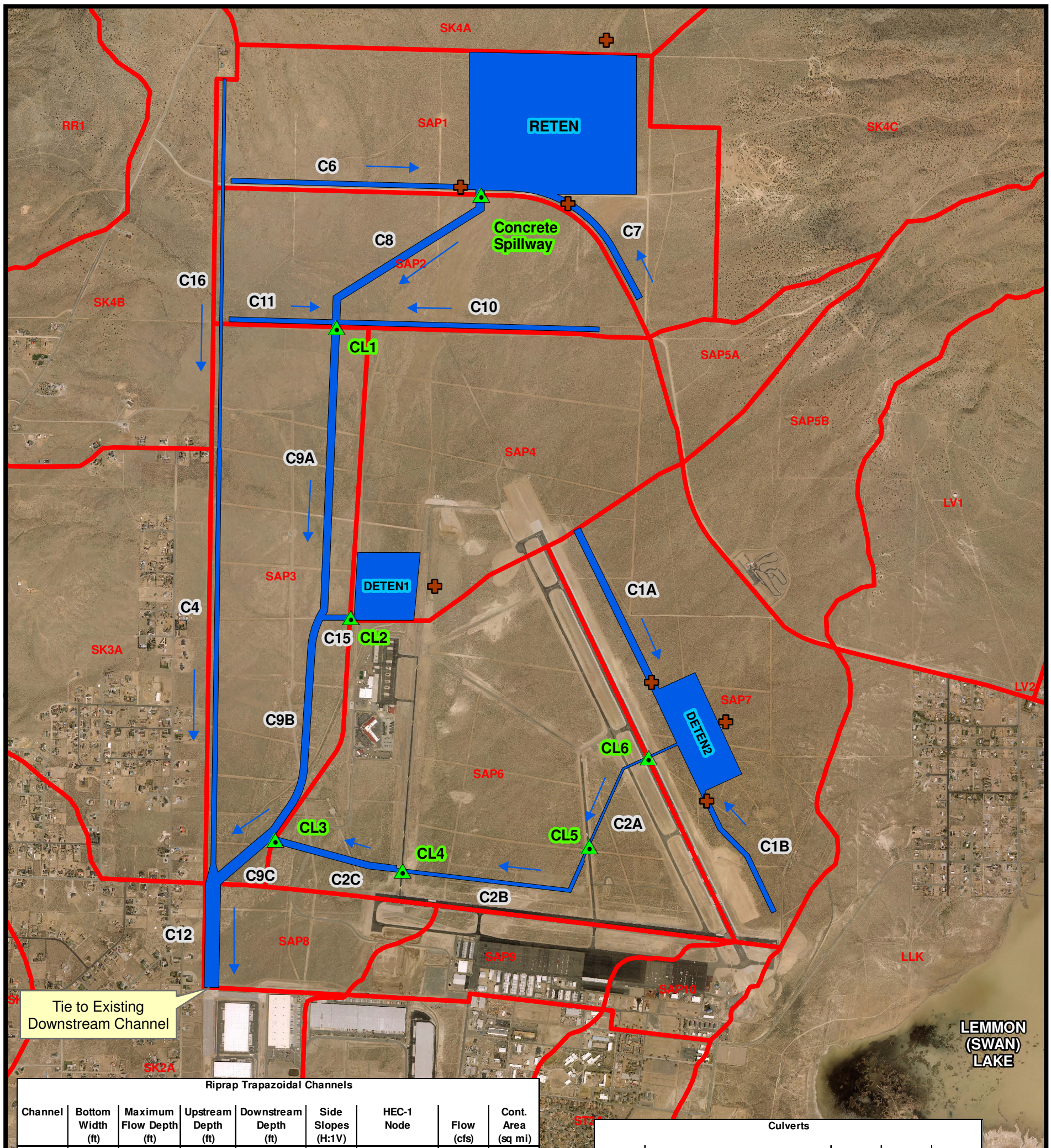
6.4 HYDRAULIC ANALYSIS

Preliminary channel and culvert sizing was based on the 100-year, 24-hour runoff event. Channels were assumed to be a minimum of 4 feet deep with a normal flow depth of 3 feet or less. This will provide for a minimum of 1-foot of freeboard in all locations. All channels were assumed to be riprap lined due to the erodible soils. Culverts were sized based on inlet control charts. RCBCs were assumed to be needed in most locations. The heights of these RCBCs were assumed to be 3 feet and operate with a headwater/depth of 1.0. This will continue to provide the 1-foot of channel freeboard at the culvert headwalls. Standard RCBC sizes were assumed as shown in **Figure 6-7**. Hydraulic backup calculations are included in **Appendix E-4**.

6.5 EROSION CONTROL

Soils within the airport property are subject to erosion even at very low flows and mild velocities. At the time of final design, additional erosion control measures will need to be evaluated and incorporated to provide for the maintainability of all drainage structures and ensure that the structures continue to function as planned. It is recommended to avoid designing unlined channels for this area. The drainage master plan has assumed that all three basins will have riprap on their side slopes and that all channels will be fully riprap lined. Additional alternative linings can be investigated at the time of final design, and the need for cutoff walls or other measures should be investigated. This drainage master plan assumes that all three basins will be classified as regional basins. Section 1302.1 of the TMRDM recommends that each basin is designed for three years of sediment storage. This drainage master plan assumes that at the time of final design, these volumes will be determined and potentially incorporated into the design and discussed with the airport staff and the City of Reno. Potential sediment storage areas are shown on Figure 6-7.

Strong winds in the area tend to accumulate tumble weeds within the drainage structures. Final design should assess the need for trash racks at all culvert crossings



Riprap Trapazoidal Channels

Channel	Bottom Width (ft)	Maximum Flow Depth (ft)	Upstream Depth (ft)	Downstream Depth (ft)	Side Slopes (H:1V)	HEC-1 Node	Flow (cfs)	Cont. Area (sq mi)
C1A	50	3	4	7	3	1/2 of CPSAP7	805	0.92+/-
C1B	40	3	4	7	3	1/2 of CPSAP7	805	0.92+/-
C2A	20	3	4	4	3	RTSAP7	98	1.83
C2B	50	3	4	4	3	CPSAP6	897	3.17
C2C	100	3	4	5	3	CPSAP6	897	3.17
C4	55	3	4	7	3	CPSK3A	1133	8.73
C6	30	3	4	10	3	1/2 of CPSAP1	1176	11.76+/-
C7	60	3	4	10	3	1/2 of CPSAP1	1176	11.76+/-
C8	90	3	10	10	3	RETEN	1089	23.52
C9A	80	3	10	10	3	CPSP42	1187	25.31
C9B	110	3	10	5	3	CPSP3	1526	26.24
C9C	165	3	5	7	3	CPSP3A	2350	29.41
C10	30	3	4	10	3	1/2 of SAP2	462	0.35+/-
C11	15	3	4	10	3	1/2 of SAP2	462	0.35+/-
C12	240	3	7	6	3	CPSAP8	2785	38.38
C15	3	3	7	10	3	DETEN1	60	1.10
C16	35	3	4	4	3	CPSK4B	707	5.57

Culverts

Culvert	Size	HEC-1 Node	Flow (cfs)	Cont. Area (sq mi)
CL1	(11) 7 ft x 3 ft RCB	CPSAP2	1129	24.21
CL2	36 in RCP w/ Restrictor Plate	DETEN1	60	1.10
CL3	(11) 7 ft x 3 ft RCB	CPSAP6	897	3.17
CL4	(11) 7 ft x 3 ft RCB	CPSAP6	897	3.17
CL5	(4) 7 ft x 3 ft RCB	RTSAP7	98	1.83
CL6	(2) 7 ft x 3 ft RCB w/ Restrictor Plate	DETEN2	98	1.83

Retention & Detention Basins

Basin (HEC-1 Node)	Storage Volume (ac-ft)	Bottom Area (ac)	Side Slopes (H:1V)	Depth to Storage (ft)	Depth to Overflow (ft)	Total Basin Depth (ft)	Flow In (cfs)	Flow Out (cfs)	Cont. Area (sq mi)
RETEN	1224	150.1	3	7	8	10	2352	1089	23.52
DETEN1	187	30.2	3	5	6	7	1033	60	1.10
DETEN2	211	34	3	5	6	7	1609	98	1.83

N

0 1,000 2,000 4,000 Feet

Legend

- Potential Sediment Storage Areas
- Proposed Culverts
- Drainage Improvements
- Watershed Boundaries

PBSJ

Reno - Stead Airport
Reno, Nevada

Proposed Drainage Improvements Map

FIGURE 6-7

and evaluate the sensitivity of channel/culvert clogging on the drainage system. Regular maintenance will be essential to ensuring that channels and culverts maintain their capacity and that the detention and retention basins continue to function as planned. In addition to regularly scheduled maintenance, the major drainage facilities should be cleaned annually at a minimum, and after every significant runoff event. Channels and culverts should be inspected for deposited sediment, erosion areas, and debris clogging to ensure conveyance capacity is maintained. The detention and retention basins should be inspected for deposited sediment, erosion areas, and debris accumulation to ensure that detention and retention volumes are not slowly reduced over time. Channels and basins near undeveloped areas are most likely to be subject to sediment deposition.

The retention basin at the north end of the property should be coordinated with Washoe County to potentially move the basin partially or wholly on Washoe County property or allow for the construction of a sediment basin within Washoe County property just upstream of the retention basin.

6.6 CONCLUSIONS

This drainage master plan is intended to serve as a guide for future airport planning and development needs and to provide a framework for future drainage design. The drainage master plan has developed drainage facilities to a conceptual level, has located drainage facilities within constrained areas where possible, and shown that future development can be accomplished as long as the identified drainage improvements are constructed. Maintenance access has not been specifically designated for the drainage improvements identified, however given the planned land uses of industrial/commercial, and airport use, it was assumed that there will be acceptable areas for maintenance access incorporated at the time of final design.

It is not possible to determine in what order the airport property will develop and over what period of time the development will occur. This drainage master plan assumes that major drainage improvements will be constructed as the airport property is developed. Each development will be responsible for developing the neighboring drainage channels and culverts, identifying any temporary drainage improvements necessary, and determining what portion of the detention or retention basins will need to be constructed prior to site development. The airport also has the ability to construct drainage infrastructure in advance of developing a specific area. In this scenario the site developer would only need to develop the onsite drainage system. Cost estimates for the preferred drainage alternative are included in **Appendix E-5** and summary cost information is provided in Chapter 8 Capital Improvement Program.

AIRPORT LAYOUT PLAN

Reno-Stead Airport

7

7.1 GENERAL

This chapter is intended to serve as an overview of the Airport Layout Plan (ALP) set required as part of the master planning process by the Federal Aviation Administration (FAA). This drawing set provides input required to determine the eligibility of proposed airport improvement projects. Generally, the FAA will not provide financial assistance for projects that are not depicted on the ALP. The drawings comprising the ALP illustrate the current 2009 facilities at Reno-Stead Airport (RTS) and the proposed developments for the near-, mid-, and long-term planning periods (2009-2030).

The ALP set has been prepared in conformity with the criteria described in FAA AC 150-5070-6B, *Airport Master Plans*, FAA AC 150/5300-13, *Airport Design,* and is adherent to the FAA Western-Pacific Region's ALP checklist.

The ALP set for RTS includes the following individual drawing sheets:

1. Cover Sheet
2. Existing Facilities
3. Airport Data Sheet
4. Airport Layout Plan
5. Terminal Area Plan
6. Runway 8-26 Approach and RPZ Plans
7. Runway 14-32 Approach and RPZ Plans
8. Runway 8-26 Part 77 Surfaces
9. Runway 14-32 Part 77 Surfaces
10. Part 77 Surfaces
11. Land Use
12. Airport Property Map

7.2 COVER SHEET

The cover sheet, shown on **Sheet 1 of 14**, serves as an introduction to the ALP set. It includes the name of the airport, a location map, vicinity map, and an index of drawings included in the ALP set.

7.3 DRAWING OF EXISTING FACILITIES

The drawing of existing facilities is a graphic representation, to scale, of the airport in its current configuration (year 2009). This drawing shows all existing airport facilities, their location, pertinent dimensions and clearance information, and the runway and taxiway infrastructure. The Existing Airport Facilities drawings are shown in **Sheet 2 of 14** and **Sheet 3 of 14**.

7.4 AIRPORT LAYOUT PLAN DRAWING

The ALP is the primary planning document for the airport and is a graphic representation, to scale, of existing and proposed airport facilities, their location, dimensional and clearance data, and the overall infrastructure of the airport including runways, taxiways, and aprons. A Data Sheet is typically used when space is not available within the ALP set for the necessary tabular information regarding the airport and its facilities, which is the case for the RTS ALP. The FAA refers to the ALP and Data Sheet when considering grant applications for development assistance and when reviewing potential impacts from off-airport development within the vicinity of the airport.

The ALP set was developed in accordance with the design criteria and guidelines contained in FAA Advisory Circulars 150/5300-13, *Airport Design,* and 150/5070, *Airport Master Plans,* as well as FAA Western-Pacific Region's ALP checklist. The information and analyses presented in the previous chapters of this report discuss the design requirements that pertain to RTS and have been incorporated into the ALP. **Sheet 4 of 14** represents the airport Data Sheet, while **Sheet 5 of 14** and **Sheet 6 of 14** illustrate the Airport Layout Plan for RTS.

7.5 TERMINAL AREA PLAN

The Terminal Area Plan presents an enlarged area of the ALP at a scale of 1"=200' and illustrates existing and proposed facilities. This area is typically comprised of the terminal building, gates, aircraft parking apron, and automobile parking, corporate hangars, and non-aviation related development areas. The Terminal Area Plan is shown in **Sheet 7 of 14**.

The Terminal Area Plan includes the portion of the airfield located to the south of Runway 8-26. The future development shown on the Terminal Area Plan includes: additional itinerant tie-down positions, future general aviation hangar development, and the new terminal facility concept.

7.6 RUNWAY APPROACH AND RPZ PLAN

The RPZ and approach profile drawing shows both plan and profile views for each runway's RPZ and approaches as shown on the ALP. The purpose of these plans is to locate and document existing objects, which represent obstructions to navigable airspace and the existing and proposed approach slopes for each runway. Additionally, the drawing shows the ground profile and terrain features along the extended centerline at each runway end. Notable objects in the vicinity are shown in the plan and profile drawings for each runway end and tabulated with heights and disposition, as appropriate on the subsequent ALP sheet. These drawings are supplemental to the Airport Airspace Plan. The Runway Approach and RPZ Plan Drawing is shown in **Sheet 8 of 14** for Runway 8-26 and **Sheet 9 of 14** for Runway 14-32.

7.7 AIRPORT AIRSPACE PLAN

FAR Part 77, *Objects Affecting Navigable Airspace,* prescribes airspace standards, which establish criteria for evaluating navigable airspace. Airport imaginary surfaces are established relative to the airport and runways. The size of each imaginary surface is based on the runway category with respect to existing and proposed visual, non-precision, or precision approaches for that runway. The space and dimensions of the respective approach surfaces are determined by the most demanding, existing or proposed, approach for each runway. The imaginary surfaces definitions include:

- **Primary Surface** – A rectangular area symmetrically located about the runway centerline and extending a distance of 200 feet beyond each runway threshold. Its elevation is the same as that of the runway.

- **Horizontal Surface** – An oval shaped, flat area situated 150 feet above the published airport elevation. Its dimensions are determined by using 10,000-foot arcs (entered 200 feet beyond each runway end) connected with a line tangent to those arcs.

- **Conical Surface** – A sloping area whose inner perimeter conforms to the shape of the horizontal surface. It extends outward for a distance of 4,000 feet measured horizontally, and slopes upward at 20:1.

- **Transitional Surface** – These surfaces extend outward and upward at right angles to the runway centerline and centerline extended at a slope of 7:1 from the sides of the primary surface and from the sides of the approach surface. Transitional surfaces for those portions of the precision approach surface, which project through and beyond the limits of the conical surface, extend a distance of 5,000 feet measured horizontally from the edge of the approach surface at right angles to the runway centerlines.

- **Approach Surface** – This surface begins at the ends of the primary surface and slopes upward at a predetermined ratio while at the same time flaring out horizontally. The width and elevation of the inner ends conform to that of the primary surface, while the slope, length, and outer width are determined by the runway service category and existing or proposed instrument approach procedures.

Sheet 10 of 14 shows the Part 77 Airspace Plan for RTS associated with Runway 8-26 and **Sheet 11 of 14** shows the Part 77 Airspace Plan for RTS associated with Runway 14-32. **Sheet 12 of 14** depicts the outermost portions of the Part 77 surfaces which were unable to fit within the scaled limits of either **Sheet 10 of 14** or **Sheet 11 of 14**.

7.8 LAND USE

The purpose of the land use plan is to identify all potential development areas on the airport's property and identify the best location for various types of development. The land use development plan for RTS identifies both aviation and non-aviation uses. Aviation use is primarily found surrounding the runway and taxiway system, while non-aviation use is located away from the airfield. Non-aviation use is comprised of industrial/commercial, retail, buffer space, and general rural uses. **Sheet 13 of 14** depicts the airport's Land Use Plan.

7.9 AIRPORT PROPERTY MAP

The Airport Property Map shows areas of existing airport sponsor ownership and areas proposed for ownership or release. The map also shows easements, buildings, aprons, fences, roads, and other features of concern. Tracts are shown for depiction purposes only and this map is not to be used for survey or land acquisition purposes. Property information includes ownership, location, purpose, book and page/reception and Federal involvement. The Airport Property Map is shown on **Sheet 14 of 14.**

CAPITAL IMPROVEMENT PROGRAM

Reno-Stead Airport

8

8.1 INTRODUCTION

The preceding chapters have identified the projects necessary for the Reno-Stead Airport (RTS) to accommodate the forecast levels of demand. As discussed in Chapter 4 Demand/Capacity Analysis and Facility Requirements and Chapter 5 Airport Development Plan, specific improvements to both airside and landside elements of the RTS are recommended for implementation over the planning period. The projects included in the development plan form the basis of RTS's capital improvement program (CIP).

The CIP includes projects that represent the facility's planned growth over the next 20 years. Additionally, the proposed facilities reflect strategic development initiatives intended to maximize the safety and utilization of the airport. As part of the development process, project phasing and cost estimates are developed and included in the CIP in order to manage and plan for the implementation requirements associated with these development projects.

8.2 DEVELOPMENT PHASING

This section applies a general schedule to the proposed airport development projects. The schedule represents a prioritized airport development plan to meet forecast increases in aviation demand and/or economic development initiatives. Projects that appear in the first phase are of greatest importance and have the least tolerance for delay. Additionally, some projects included in an early phase may be a prerequisite for other planned improvements in a later phase. The development phasing for RTS has been divided into three phases as follows:

- Phase I: (0-5 years), 2009-2013
- Phase II: (6-10 years), 2014-2018
- Phase III: (11-20 years), 2019-2028

The phasing of individual projects should undergo periodic review to determine the need for changes based upon variation in forecast demand, available funding, economic conditions, and/or other factors that influence airport development. It should be noted that other projects not foreseen in this report may be identified in the future and would therefore, likely necessitate changes in the phasing of projects and the overall CIP. Further, the projects and overall development identified in the CIP, though tied to a timetable, will only occur once the demand and/or need is demonstrated for each project. Phasing for the projects included in the development plan is shown in **Table 8-1.**

Table 8-1. Airport Capital Improvement Program

Proposed Development Program	Phase I 2009-2013	Phase II 2014-2018	Phase III 2019-2028
Runway 8-26 RSA Compliance	✈		
Runway 14-32 RSA Compliance	✈		
Stormwater Drainage Improvements	✈		
Itinerant Aircraft Expansion	✈		
Taxiway D Rehabilitation	✈		
Terminal Building & Parking Development	✈		
ILS and Approach Lighting System Runway 26		✈	
Air Traffic Control Tower Implementation		✈	
Runway 8-26 Rehabilitation		✈	
Hangar Development			✈
Closed Taxiway Rehabilitation			✈
Future Parallel Taxiways			✈
Itinerant Aircraft Expansion			✈

Source: PBS&J, 2009.

8.3 DEVELOPMENT CONSIDERATIONS

In order to determine the approximate funding requirements for the planning period, it is necessary to identify the potential development costs associated with the selected airport development plan.

The cost estimates presented in the following pages are based upon adjusted 2009 dollars and are calculated for order-of-magnitude purposes only. Actual construction costs will vary based upon inflation, variations in labor and changes in the type or cost of materials used, as well as other unforeseeable economic factors. Furthermore, federal grant assistance and eligibility may also vary from year to year. Therefore, a review of the development costs and overall CIP should occur as conditions warrant.

Based on the construction of all projects outlined in Chapter 5 Development Plan and depicted on the Airport Layout Plan (ALP), the construction costs in dollars are summarized in **Table 8-2**. This table is based upon current federal eligibility criteria only and does not represent a commitment for funding by the respective funding sources. The local column depicts the Reno Tahoe Airport Authority (RTAA) share of the costs, which may be shared with other entities (i.e., current and future tenants, third party developers, etc.) depending on the development and/or funding approach applied to each project.

Detailed 20-year cost estimates for development Phases I through III, including planning, construction, engineering, and total overall development costs, are found in **Appendix F** of this report.

Table 8-2. Summary of Cost Estimates – Full Build-Out

Development Period	Total	Federal (FAA)	Local (RTAA)	Other
Phase I (2009– 2013)	$120,703,000	$11,670,550	$7,126,450	$101,906,000
Phase II (2014 – 2018)	$31,014,000	$29,720,000	$1,294,000	$0
Phase III (2019 – 2028)	$51,720,000	$49,134,000	$2,586,000	$0
Total Estimated Development Costs	**$203,437,000**	**$90,524,550**	**$11,006,450**	**$101,906,000**

Notes:

The funding amounts and project eligibility presented are based on current FAA guidelines but do not constitute approval, acceptance or a commitment of funding by the FAA and should only be used for planning and budgeting purposes.

Source: PBS&J, 2009.

8.4 CAPITAL IMPROVEMENT PROGRAM

The objective of this section is to outline the CIP for RTS for the next 20 years and provide a brief description of the projects included. Special attention has been placed on the first five years of the CIP. These projects slated for immediate implementation have been identified as critical to RTS in terms of providing adequate facilities to meet the needs of its users.

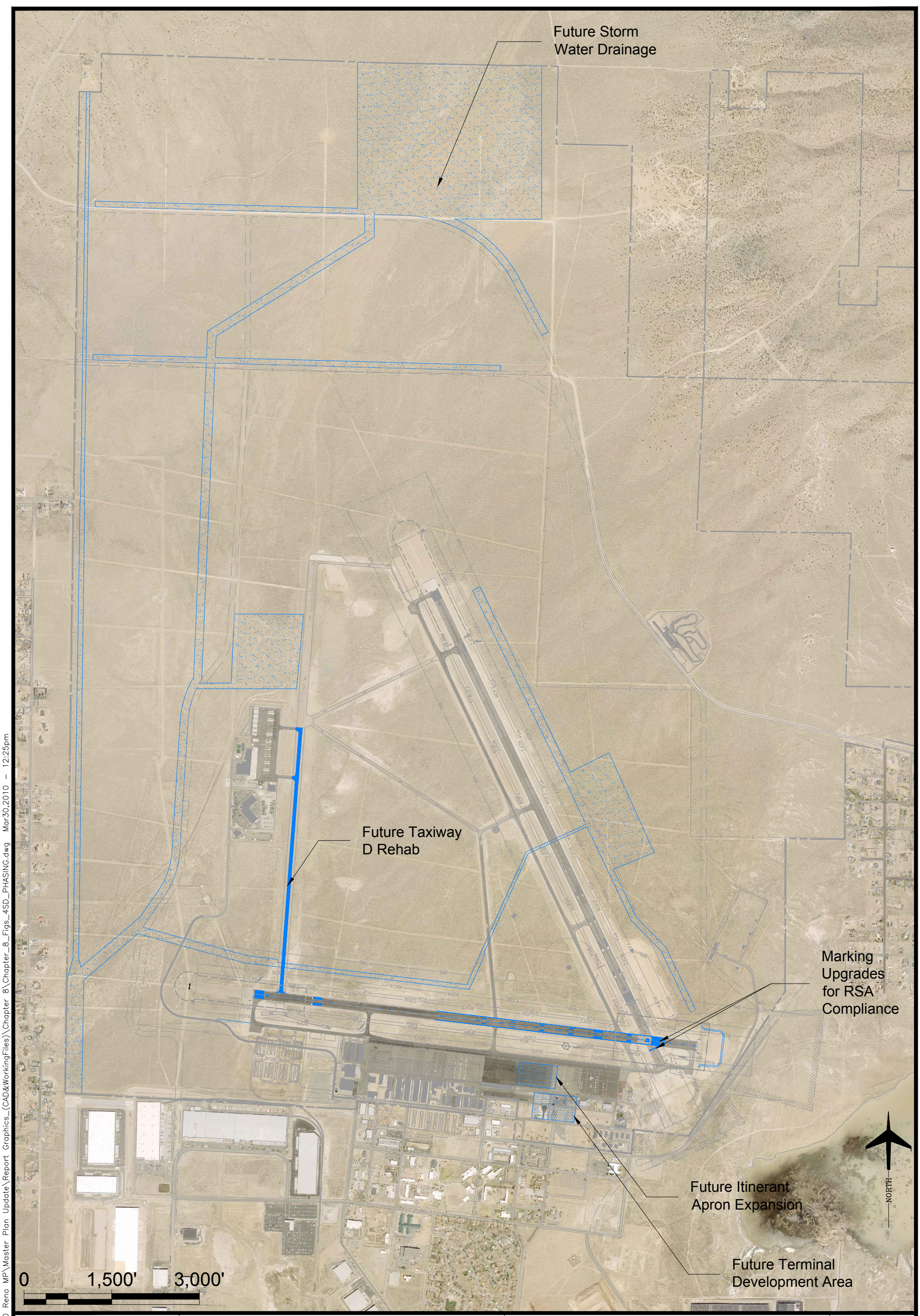
On the following pages, projects are identified and denoted in each phase of RTS's CIP as shown in **Tables 8-3**, **8-4** and **8-5** and **Figures 8-1 through 8-4**.

Table 8-3. Capital Improvement Program Phase I (2009-2013)

Year	Project Description and Title	Estimated Total Cost	Funding Sources	
2010	**Runway 8-26 RSA Compliance – Runway Extension & Declared Distances** The *Reno-Stead Airport RSA Standards Compliance Study Final Report, October 2008* prepared by URS Corporation recommended, after considering other viable alternatives, the construction of a 575-foot westerly extension to Runway 8-26 and implementing 575-foot threshold displacements on both the 8 and 26 runway ends. This project will ensure adequate RSA length beyond each runway end, thereby providing a safer operating environment for aircraft.	**$ 6,500,000**	Federal (FAA)	95% or $6,175,000
			Local	5% or $325,000
			Other	$0
2010	**Runway 14-32 RSA Compliance – Declared Distances** The *Reno-Stead Airport RSA Standards Compliance Study Final Report, October 2008* prepared by URS Corporation recommends, after considering other viable alternatives, relocating the end of Runway 32 by 320 feet and applying declared distances. Also, minor grading work beyond the pavement edge would be required to meet RSA requirements beyond the pavement. Similar to the RSA compliance effort for Runway 8-26, this project will ensure adequate RSA length beyond each runway end, thereby providing a safer operating environment.	**$ 1,011,000**	Federal (FAA)	95% or $960,450
			Local	5% or $50,550
			Other	$0
2011	**Drainage Improvements** To enable future development of primarily non-aviation land uses at RTS a conceptual drainage master plan was established to manage the peak stormwater flows during times of heavy rains. The hydrologic analysis completed for this master plan shows that the future watershed condition 100-year, 24-hour peak flows downstream of the airport property will not exceed the existing watershed condition flow rates. Future on-site flows increase due to development. These flows are reduced to existing flow rates by two detention basins and one retention basin.	**$ 101,906,000**	Federal (FAA)	$0
			Local	$0
			Other	100% or $101,906,000

Table 8-3. Capital Improvement Program Phase I (2009-2013) (Continued)

Year	Project Description and Title	Estimated Total Cost	Funding Sources	
2012	Itinerant Aircraft Expansion – Additional 28 Tiedown Positions At present roughly 33,000 square yards of apron is reserved for itinerant aircraft, but 43,200 square yards will be required by 2015 to allow for 120 itinerant aircraft. Itinerant aircraft parking area should be increased by adding additional striping and grommets, as needed to meet the forecast demand. Considering the BLM leased area on the apron's east edge, additional tie down markings and hardware should be added to the west of the existing itinerant apron.	**$ 80,000**	Federal (FAA)	95% or $76,000
			Local	5% or $4,000
			Other	$0
2012	Taxiway D Rehabilitation Taxiway D at RTS is located on the west side of the airport and runs north and south connecting the NVANG apron area with the approach end of Runway 8. Currently this taxiway is designed to Group II standards and has a weight bearing capacity of only 12,500 pounds (Single Wheel Gear). This taxiway is recommended to be widened and strengthened to comply with Group III standards. This taxiway, once rehabilitated, will enable the development of hangars or other aviation uses both east and west of the taxiway, thereby providing the next logical location to expand aviation development once the areas along the southern property line are built out.	**$ 4,378,000**	Federal (FAA)	95% or $4,159,100
			Local	5% or $218,900
			Other	$0
2012	Terminal Building Development and Parking The existing terminal facility at RTS is only 1,700 square feet and considered significantly undersized when considering peak hour passenger levels over the planning period. Analysis from Section 4.9 *Terminal Building and FBO* identified that an appropriate size for the RTS terminal building would be roughly 10,000 square feet. The existing terminal building cannot be expanded but is in a good location. Therefore, the current terminal facility should be replaced with a larger one in the same general area. Also, adequate parking should be provided around the terminal so as to encourage patrons to park away from aircraft aprons as much as possible.	**$ 6,828,000**	Federal (FAA)	$300,000
			Local	95% or $6,528,000
			Other	$0
Subtotal for 2010				**$7,511,000**
Subtotal for 2011				**$101,906,000**
Subtotal for 2012				**$ 11,286,000**
PHASE I SUBTOTAL				**$ 120,703,000**



PBS&J

Reno Stead Airport
Reno, Nevada

Phase I
Development Plan

Figure
8-1

Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 8\Chapter_8_Figs_4SD_PHASING.dwg Mar30,2010 - 12:25pm

Table 8-4. Capital Improvement Program Phase II (2014-2018)

Year	Project Description and Title	Estimated Total Cost	Funding Sources	
2016	Runway 8-26 Rehabilitation Runway 8-26 pavement would be rehabilitated in order to maintain level of safety for aircraft operations.	$20,880,000	Federal (FAA)	95% or $19,836,000
			Local	5% or $1,044,000
			Other	$0
2017	ILS and Approach Lighting System for Runway 26 The new ILS instrument approach to Runway 26 will enhance the airfield's overall capacity during instrument meteorological conditions.	$ 5,134,000	Federal (FAA)	100% or $5,134,000
			Local	$0
			Other	$0
2017	Air Traffic Control Tower Implementation The development of an Air Traffic Control Tower will allow for controlled airspace around RTS and increase safety of air operations at the field. *	$ 5,000,000	Federal (FAA)	95% or $4,750,000
			Local	5% or $250,000
			Other	$0
Subtotal for 2016				**$ 20,880,000**
Subtotal for 2017				**$ 10,134,000**
PHASE II SUBTOTAL				**$ 31,014,000**

*Air Traffic Control Tower costs range from $1,450,000 to 8,250,000. An estimate of $5,000,000 was applied for this cost estimate.

Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 8\Chapter_8_Figs_4SD_PHASING.dwg Mar30,2010 - 12:26pm

PBS&J®

Reno-Tahoe Airport Authority
P.O. Box 12490
Reno, Nevada 89510
Phone: 775-328-6400
Fax: 775-328-6510

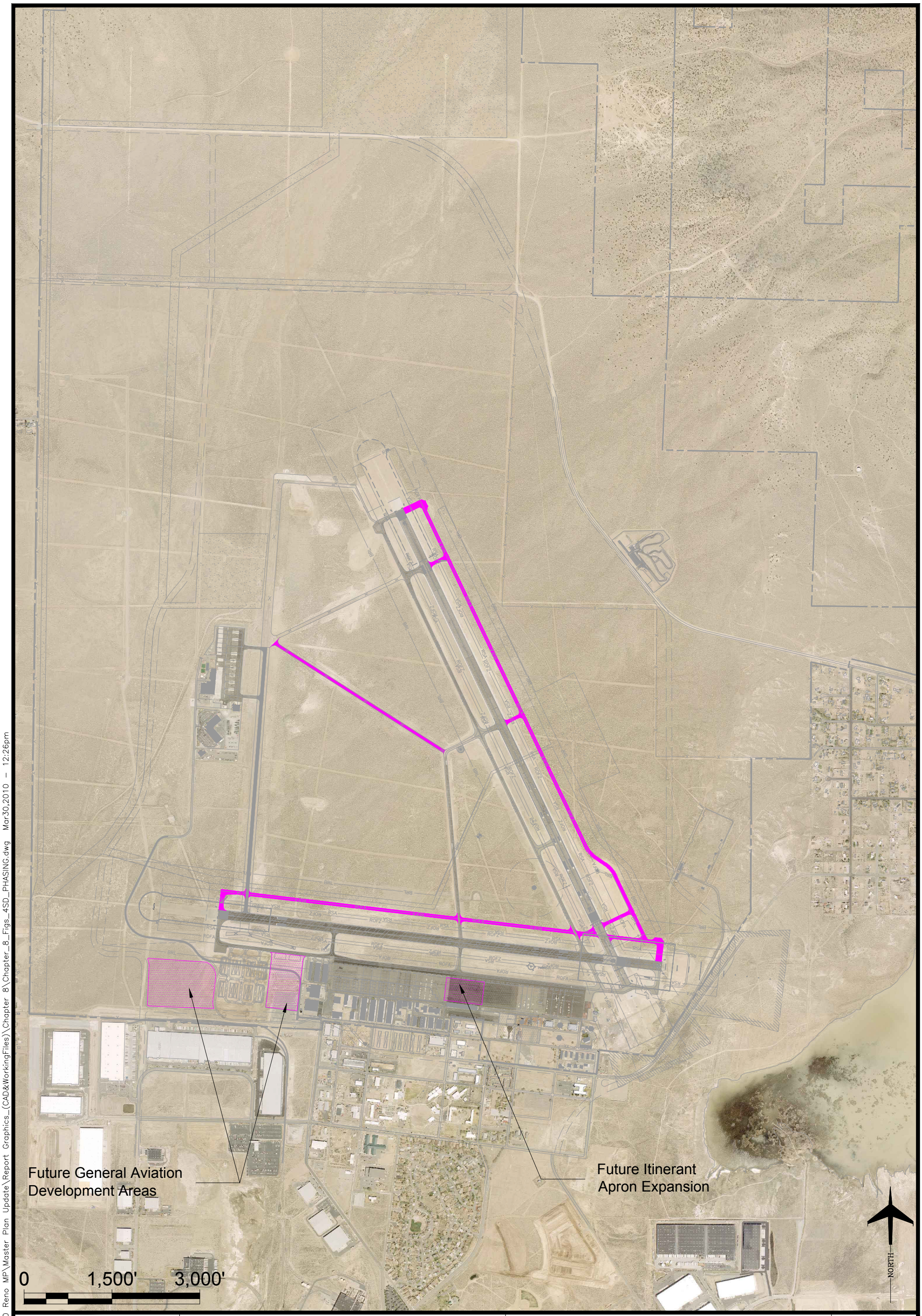
Master Plan Update
Reno-Stead Airport
Reno, Nevada

Phase II
Development Plan

Figure
8-2

Table 8-5. Capital Improvement Program Phase III (2019-2028)

Year	Project Description and Title	Estimated Total Cost	Funding Sources	
2024	Hangar Development 54 additional hangars will be needed by 2030 to facilitate the anticipated growth in based aircraft at RTS. The area immediately west of the current hangar development is considered the best location for the additional 54 hangars determined to be required by 2030. Since civil infrastructure such as roads and utilities already exist on the south side of the airport and based GA aircraft are found predominantly in the southwest corner, this location proved to be the most appropriate for hangar development.	$ 7,541,000	Federal (FAA) Local Other	95% Or $7,163,950 5% or 377,050 $0
2024	Closed Taxiway Rehabilitation The closed taxiway connecting the north end of Taxiway D with Taxiway C is recommended for rehabilitation. When operational, this taxiway will connect all areas of the airport more efficiently and create valuable airfield frontage for future development. This taxiway is recommended to be widened and strengthened to comply with Group III standards.	$ 7,130,000	Federal (FAA) Local Other	95% or $6,773,500 5% or $356,500 $0
2024	Future Parallel Taxiways Each RTS runway is recommended to be equipped with dual parallel taxiways in the future. Additional parallel taxiways help to increase capacity, provide for a safer airfield environment, and enable aviation related development in areas currently inaccessible by aircraft. Existing and future parallel taxiways should be planned and constructed to the same design criteria as the runway it is intended to serve. Being the ultimate Airport Reference Code (ARC) for each runway is C-III, taxiways should also be designed to that standard.	$ 36,740,000	Federal (FAA) Local Other	95% or $34,903,000 5% or $1,837,000 $0
2024	Itinerant Aircraft Apron Expansion At present roughly 33,000 square yards of apron is reserved for itinerant aircraft, but 65,000 square yards will be required by 2030 to allow for 181 itinerant aircraft. A 10,000 square yard addition is scheduled in phase one and therefore 22,000 additional square yards of itinerant apron will need to be added by 2030 to provide a total of 65,000 square yards. Itinerant aircraft parking area should be increased by adding additional striping and grommets, as needed to meet the forecast demand. Considering the BLM leased area on the apron's east edge, additional tie down markings and hardware should be added to the west of the existing itinerant apron.	$ 309,000	Federal (FAA) Local Other	95% or $293,550 5% or $15,450 $0
Subtotal for 2024				**$ 51,720,000**
PHASE III SUBTOTAL				**$ 51,720,000**



PBS&J	Reno Stead Airport Reno, Nevada	Phase III Development Plan	Figure 8-3

Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 8\Chapter_8_Figs_4SD_PHASING.dwg Mar30,2010 - 12:26pm

Legend

- PHASE I (2009-2013)
- PHASE II (2014-2018)
- PHASE III (2019-2028)

0 1,750' 3,500'

NORTH

PBS&J	Reno Stead Airport Reno, Nevada	Phases I, II, III Development Plan	Figure 8-4

Plotted By: 23208
J:\AVServ\071889.00 Reno MP\Master Plan Update\Report Graphics_(CAD&WorkingFiles)\Chapter 8\Chapter_8_Figs_4SD_PHASING.dwg Mar30,2010 - 12:27pm

8.5 IMPLEMENTATION

The purpose of this section is to analyze RTS's historical and projected revenue and expenditures and determine whether it is financially viable to implement the airport Master Plan's capital improvement program (CIP). The objective of this updated financial analysis is twofold:

- Estimate the capital and operating costs for the various components that comprise the CIP.
- Determine if it is feasible for the airport to generate sufficient revenues to cover capital and operating costs.

8.5.1 Historical Airport Financial Data

8.5.1.1 Revenue Sources

Fiscal year revenues were collected over an historical five-year period. As presented in **Table 8-6**, the major sources of airport revenue are generated from airport rentals. Other sources include fuel flowage and landing fees and concession revenue from the National Championship Air Races and Air Show. Within a five-year period, airport revenue has fluctuated with a decrease within the period of fiscal year 2004 to 2006 and followed by a large jump in fiscal year 2007. Overall, during this period, revenues increased at an average annual growth rate of .99 percent.

8.5.1.2 Expenses

As presented in **Table 8-7**, expenses cover salary and benefits, utilities and communications, purchased services (including consultants), materials and supplies, and administrative costs. Within a five-year period, expenses have increased at an average annual growth rate of 6.1 percent.

Table 8-6. Historical Revenues

	FY2004	FY2005	FY2006	FY2007	FY2008
Aircraft Fees					
Fuel Flowage	$8,208	$10,154	$16,119	$16,725	$16,855
Landing Fees	$10,246	$2,209	$8,836	$11,936	$21,216
Fixed Base Operators	$24,680	$23,390	$22,127	$28,239	$18,751
Concession					
RARA	$26,096	$22,717	$23,465	$20,291	$22,173
Other	$0	$0	$0	$1,518	$258
Rentals					
Building	$67,734	$60,796	$59,069	$66,295	$68,568
Hangar	$239,071	$238,587	$191,174	$236,591	$242,345
Airfield	$45,528	$49,117	$47,276	$44,456	$51,099
Land	$128,703	$136,887	$166,372	$172,846	$139,514
Sewer Use Fee	$4,904	$8,588	$7,467	$6,767	$8,698
Wash Rack	$363	$132	$86	$226	$231
Mini Warehouse	$10,061	$10,925	$9,740	$10,216	$9,985
Other	$18,865	$18,577	$24,100	$28,456	$14,343
Total Revenue	**$584,459**	**$582,079**	**$575,831**	**$644,562**	**$614,036**

Source: RTAA, 2009.

Table 8-7. Historical Expenses

	FY2004	FY2005	FY2006	FY2007	FY2008
Personnel Services	$457,222	$425,306	$484,549	$475,066	$542,441
Utilities and Communications	$54,802	$62,192	$76,728	$77,160	$63,656
Purchased Services	$58,071	$34,203	$31,438	$24,721	$25,546
Materials and Supplies	$75,134	$71,368	$101,588	$95,612	$105,782
Administrative Expense	$1,978	$4,842	$2,579	$2,886	$2,680
Fixed Assets	$48,739	$3,950	$34,862	$205,141	$196,164
Total Expenses	**$695,946**	**$601,861**	**$731,744**	**$880,586**	**$936,269**

Source: RTAA, 2009.

During the period cited, expenditures exceeded revenue. **Table 8-8** summarizes the historical revenues, expenses, and losses. Since RTS is part of an airport system that includes the Reno-Tahoe International Airport, the shortfall in operations and maintenance cost recovery at RTS is subsidized by the overall revenue generating capabilities of the RTAA.

Table 8-8. Historical Financial Analysis

	FY2004	FY2005	FY2006	FY2007	FY2008
Total Revenues	$584,459	$582,079	$575,831	$644,562	$614,036
Total Expenses	$695,946	$601,861	$731,744	$880,586	$936,269
Annual Profit (Loss)	($111,487)	($19,782)	($155,913)	($236,024)	($322,233)

Source: RTAA, 2009.

8.5.2 Projected Revenue and Expenses

Revenues that RTS generates in the future will be derived primarily from the same sources it generates from today, including: landing fees, fuel flowage fees, building leases, land leases, and revenue from FBO operations. Based upon existing aviation lease agreements, current construction of hangars on the airport, and assuming any vacant buildings are leased, annual fiscal year revenues were estimated during the planning period and are presented in **Table 8-9**. Revenues were increased based on language contained in existing lease agreements which calls for annual increases based on the Consumer Price Index (CPI). For the purposes of this analysis, total revenues were projected using a CPI of 3.5 percent (based on 2008). Total expenses were projected to increase applying an average annual growth rate from fiscal year 2007 to fiscal year 2008, which was calculated to be 6.3 percent.

Table 8-9. Projected Revenue and Expenses

	FY 2010	FY 2015	FY 2020	FY 2025	FY 2030
Total Revenues	$657,770	$1,406,224	$1,552,849	$1,726,993	$1,933,822
Total Expenses	$1,085,958	$1,058,420	$1,438,144	$1,954,099	$2,655,161
Annual Profit (Loss)	($428,188)	$347,804	$114,705	($227,106)	($721,339)

Source: PBS&J, 2009.

As can be seen in Table 8-9, projected revenues will not exceed expenditures as activity continues to increase at the airport without more aggressive utilization of the land and facilities available. It should also be mentioned that RTS is and can continue to be subsidized by RNO, if necessary. Additional revenue generation at the airport is very likely from the development of commercial/industrial areas on –airport over the planning period. RTS has what most airports in the U.S. do not have and that is available and developable land. If 20 acres of available land was developed every two years, projected revenue would be $250,000. This potential revenue source is added to the Table 8-9. As shown, the additional revenue allows RTS to support all expenses in the near- to mid-term. It is anticipated that operating revenues will outpace expenses in the long-term.

8.5.3 Capital Program Funding Sources

8.5.3.1 Federal Funding

The Airport receives development funding from the Federal Aviation Administration (FAA) through the Airport Improvement Program (AIP). The FAA funds General Aviation (GA) airport development projects by two means: GA entitlement and AIP discretionary funds. Airports typically receive AIP discretionary funding for federally eligible projects such as:

- New runways, taxiways, and non-exclusive use aprons
- Reconstruction of runways, taxiways, and non-exclusive aprons
- Navigational aids
- Federal air traffic control towers (ATCT)
- Passenger terminal buildings (non revenue areas only)
- Primary airport access roads
- Land acquisition

Eligible FAA projects costs at RTS are covered up to 95 percent; the remaining 5 percent is the responsibility of the RTAA. The 1999 reauthorization of the AIP legislation (AIR 21) set aside, for the first time, GA entitlement funding specifically reserved for GA airports. Eligible airports (including RTS) may receive up to $150,000 per year.

8.5.3.2 Local Funding

The balance of project costs, after consideration has been given to federal and state grants, is typically funded through the airport sponsor's local resources. Reno-Tahoe

Airport Authority (RTAA) operates and maintains both Reno-Tahoe International Airport (RNO) and RTS. RTAA has created a "special" fund that sets aside 35 percent of the gaming revenues generated at RNO to cover the local share costs of these projects at RTS. Historically, revenues of approximately $850,000 to $900,000 annually have been placed in this fund which has easily covered the local share cost of capital improvements.

8.5.3.3 Other Funding

Several assistance and funding programs not related to FAA are available to airports. These include:

- Economic Development Assistance Grants (EDA) – Managed by the US Department of Commerce – grants are made available to assist in financing industrial park development.
- Transportation Act of the 21st Century (TEA-21) – Airports eligible for access road development and intermodal-related projects.
- Small Cities Community Development Block Grant (CDBG) Section 108 Loan Guarantee Program – Offered by the Nevada Commission on Economic Development, this program provides a mechanism for small cities to access funds for larger community development projects. Both the City of Reno and City of Sparks are listed as CDBG entitlement cities, which allows the City to determine how CDBG money is spent assuming certain general federal requirements are met.
- Private Third Party Financing - Many airports use private third party financing when the planned improvements will be primarily used by a private business or other organizations. Such projects are not ordinarily eligible for Federal funding. Projects of this kind typically include hangars, FBO facilities, fuel storage, exclusive aircraft parking aprons, industrial aviation use facilities, non-aviation office/commercial/industrial developments, and various other projects. Private development proposals are considered on a case-by-case basis. Often, airport funds for infrastructure, preliminary site work, and site access are required to facilitate privately developed projects on airport property.

8.5.4 Summary

Revenues the airport generates now and in the future will come primarily from commissions on services provided, hangar and building rental fees, and land leases. Additional revenues will come from landing fees on aircraft, and terminal fees. Construction of new hangars to meet the existing demand represents significant opportunities to generate additional revenue. However, the greatest opportunity for financial sustainability rests with the successful marketing and overall development of the airport. There is approximately 3,000 acres of land that is available for non-aviation development which over time will generate a substantial revenue stream.

The revenues and expenses associated with the different funding sources available vary significantly and thus, further analysis of the financial feasibility of each project will be necessary prior to the time of grant application and overall project implementation.